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ABSTRACT

The second research report in a continuing investigation of group communication via computer networks describes a series of field tests designed to identify the basic parameters of human interaction in computer-based teleconferencing. The method used in the tests is described, and the research approach used in analyzing the tests is outlined. Ten conferences involving small groups ranging from 3 to 30 participants are described in detail and analyzed according to a taxonomy of group communication developed in collaboration with other research groups. The possible impact of computer-based communication on work patterns and its potential as a medium for networks of disseminated persons are explored and evaluated. A statement of statistical results and a bibliography are appended. (Author/SK)

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GROUP COMMUNICATION THROUGH COMPUTERS

Volume 2: A Study of Social Effects

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PROJECT STAFF AND ACKNOWLEDGMENTS

Responsibility for supervision of this project has been divided between Roy Amara (administrative management) and Jacques Vallee (direction of system design and experimental programs). The programming effort was primarily performed by Hubert M. Lipinski and Richard H. Miller. Social research design and analysis have been the responsibility of Robert Johansen. Robert Randolph, Arthur Hastings, and Andrew Hardy have contributed directly to the development of the methodology described in this volume. Thaddeus Wilson has performed the data reduction and user services functions. Ann McCown has implemented the FORUM reporter program. Several other Institute staff members also contributed to this research, notably Olaf Helmer, Paul Baran, Andrew J. Lipinski, Vicki Wilmeth, and Kathleen Spangler, who deserves special credit for her editing of our manuscript.

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The users of FORUM deserve much of the credit for making the system a living reality. Although we cannot list all their names, may they find here our sincere thanks.

SUMMARY OF VOLUME II

This document constitutes the second research report in a continuing investigation of group communication via computer networks. An earlier report* described in detail the design and implementation of a system called FORUM; this system has served as the basis for a series of field tests designed to identify the basic parameters of human interaction in computer-based teleconferencing.

Considerable interest has been created by the observation that computer networks might soon link together human participants in cost-effective group discussions across geographic and political boundaries. In the course of the research described here, we have had the opportunity not only to organize such conferences but to evaluate them with an increasing degree of precision. Our results suggest that efficient communication can take place, often among persons who have not previously been in contact with each other and at what appears to be cost-effective rates. We have found that interaction within conferencing groups has *not* been related to prior face-to-face acquaintance of participants but has represented new patterns of association. We have established that the integration of large-scale data bases within the context of ongoing conferences is technically feasible. Finally, we have also observed an increasing trend toward problem-solving activity among groups using FORUM, an observation which, together with other factors, has encouraged us to undertake extended experiments in operational settings.

Ten conferences involving small groups which range in size from 3 to 30 participants are described in detail in the present report. The analysis of these conferences is based on a taxonomy of group communication through electronic media. This taxonomy has been developed in collaboration

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*Jacques Vallee, Hubert M. Lipinski, and Richard H. Miller, *Group Communication through Computers--Volume 1: Design and Use of the FORUM System*, Institute for the Future, Report R-32, July 1974.

with a number of other research groups active in this field and has led to the identification of a set of specific statements that describe basic managerial, social, and economic issues in computer-based interaction. The most significant findings to date have been related to the possible impact of computer-based communication on work patterns and its considerable potential as a novel medium for networks of disseminated persons. Our current evaluation of its potentials, as well as its problems, is presented in this report.

A statement of statistical results and an extensive bibliography are also provided.

I. HUMAN INTERACTION THROUGH ELECTRONIC MEDIA

I. HUMAN INTERACTION THROUGH ELECTRONIC MEDIA*

New media of communication have traditionally been born of the dreams of technologists and released to the general public with little thought or research concerning likely social effects or necessary regulation. Initial development expenditures emphasize technological feasibility and dollar costs as measures of utility, with social scientific research used only in later stages of analysis. The almost nonexistent literature on the sociology of the telephone--invented almost 100 years ago--is only one example of this phenomenon. A generally acknowledged bibliography on small group research by McGrath and Altman** contains 2,699 entries, only six of which deal with situations other than face-to-face communication.

Our own involvement in this research began with a computer program called FORUM. FORUM functions as a medium of interpersonal communication for such activities as group conferencing, joint writing projects, electronic notepads, and questionnaires. It is one of a growing number of computer-assisted teleconferencing systems in various stages of development.*** FORUM allows people who may be geographically separated to communicate either in real time or on a delayed basis. In addition to its operation as a conferencing device or questionnaire generation apparatus, FORUM serves as a limited storage-and-retrieval system with the various conferences as the data base. The form of all communication within FORUM is currently limited to input from computer terminals although some experiments with a parallel voice channel have been conducted.

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*Portions of this report have been published previously in several professional articles. See the Bibliography at the end of this report for specific titles.

**Joseph E. McGrath and Irwin Altman, *Small Group Research*, New York: Holt, Rinehart & Winston (1966).

***See *Group Communication through Computers--Volume 1: Design and Use of the FORUM System*, Institute for the Future, Report R-32, July 1974.

In order to begin with the assumption that FORUM is a "communications medium", we must clarify the meaning of this term. From an engineering point of view, a "medium" involves only the inherent properties of a particular transmission environment. However, the narrow definition of "medium" has been extended in most social research to include any system which is used for conveying messages among persons. Thus, face-to-face communication can be considered a medium of communication, even though the physical medium which is actually being used is the atmosphere. This report assumes a broad notion of a communications medium, including the social conventions associated with the transmission environment.

The criteria for evaluation of a medium of communication typically involve comparison with other media. Since the medium most familiar to the majority of us is face-to-face communication, there is a tendency for this to become the standard of judgment. For example, Anna Casey-Stahmer and Dean Havron have studied groups of people gathered at communications stations and interacting with groups at other stations, comparing the amount of electronic communication between stations with the communication within the face-to-face groups at each site.* This approach has offered interesting data, but it should not lead us to assume that face-to-face communication is the "ideal" medium. One needs to exhibit great care in such comparisons because telecommunications media are not necessarily surrogates for face-to-face patterns. It seems more likely that each medium has *its own inherent characteristics* which should not be expected to mimic face-to-face patterns. At the same time, computer-based systems are too often evaluated and analyzed solely in their own terms. In the case of FORUM, we want to relate observations of the medium to an external standard--one which can apply to many media--as much as feasible.

In turning to the literature of group communication, however, we do not readily discover general principles or procedures which are easily adopted as "standard". Instead we find a scattered literature, often highly specialized, which lacks coordination. Individual researchers (and often "schools" of thought) provide rich information within strikingly narrow frames of

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*Anna E. Casey-Stahmer and M. Dean Havron, *Planning in Teleconference Systems*, Human Sciences Research Institute (November 1973).

Figure 1. The FORUM Environment
Top: Olaf Helmer and Jacques Vallee using a hard-copy terminal
Bottom: Robert Johansen typing at a cathode ray tube (CRT) device

reference. Also, with respect to social dynamics, these research efforts concentrate almost exclusively on face-to-face communication. Beyond the literature of face-to-face, group process research, little has been done to apply derived principles of face-to-face group communication to other media.

In 1963, Alex Bavelas offered this summary appraisal of the relationship between the research in face-to-face communication and that in electronically mediated group communication:

> "...the findings are, in most cases, only remotely related to teleconferencing. The significant contribution of this work lies instead in the methods and techniques of quantitative study that have been developed, and in general hypotheses about social process in terms of which specific propositions relating to teleconferencing may be formulated."*

Bavelas went on to say: "It appears that published information bearing directly on teleconferencing is practically nonexistent".** And although much relevant research has been done within the last ten years, the lack of published material remains as obvious as at the time of Bavelas' observation.

Certainly the literature of group process is broad and provocative, and the potential for relating group process research to communication research is real, though complicated by many factors. Alex Reid, while recognizing the complexities, offers an optimistic view of near-future possibilities:

> "There seems every opportunity for a fruitful transfer of both theory and experimental method from social psychology to telecommunications engineering, a transfer that will be particularly valuable as the telecommunications system moves away from simple one-to-one voice communication toward more sophisticated visual and multi-person systems."***

With this background on social research in telecommunications, the design of social research performed so far with FORUM can be summarized around two sets of questions:

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*Alex Bavelas, *Teleconferencing: Background Information,* Research Paper P-106, Institute for Defense Analysis (1963), p. 4.

**Ibid., p. 12.

***Alex Reid, *New Directions in Telecommunications Research,* a report prepared for the Sloan Commission on Cable Communications (June 1971), p. 39.

1. What are the operational characteristics of FORUM as a communications medium? What are the characteristic social patterns of FORUM communication, and how might these be altered?

2. What are the likely social effects of communicating via FORUM on the individual and on the group? How can these social effects be measured? How can FORUM be compared to other media?

In designing FORUM research to answer the first set of questions, we have devised a method for plotting characteristic social patterns and for analyzing the resulting graphs. Samples of these graphs appear in Chapter III of this report and in Appendix 1.

In the second set of questions, the problem of comparison with other media has led to a search for a general taxonomy--that is, a comprehensive classification system for elements of group communication--which could be employed across media in various group communications situations. Such a taxonomy would frame the most fundamental questions which must be asked in order to assess a particular communication situation involving any group. These questions must apply across media (including face-to-face), and they must be flexible enough to encourage development of a broad range of research techniques. Some components of a preliminary taxonomy are proposed in Chapter II of this report.

The second set of questions has further led to the development of a variety of measures for evaluating social effects and to the application of these measures in field tests. Finally, we have been able to extract a set of hypotheses for continued testing.

Through the development of the computer conferencing medium and the identification of its parameters, we have been able to experiment with a tool for interpersonal communication as well as for the study of that communication. The improvement of interaction among groups of experts is a special case of central interest. With a computer-based communications tool, it is possible to test a wider set of hypotheses than has been previously accessible to researchers who have explored the value of the Delphi and other techniques for the aggregation of group judgment. While the present report is but one step toward this improvement, we have established with it a baseline for future efforts.

II. RESEARCH APPROACH

II. RESEARCH APPROACH

A. METHODOLOGICAL FOUNDATIONS

The social research which is currently being done by various groups studying personal communications media can be divided into three, sometimes overlapping categories:

- Laboratory experiments
- Field tests
- Survey research

A summary of these groups, together with their research styles, is presented in Figure 2.

1. Laboratory Experiments

The classic research approach arises out of the traditions of experimental psychology. The goal here is to control and manipulate certain key elements (independent variables), while monitoring the resultant effect on other elements (dependent variables). To minimize the problems in monitoring the many variables surrounding a social situation, laboratories are used to establish a controllable environment. These laboratories are then designed in such a way that they replicate (or at least approximate) the "real world".

In the case of communications research, the problems of control have been magnified. In even the most "simple" instances of interpersonal communication, multiple complexities are always present. A researcher must attempt to isolate the effects of a communications medium from the interrelated effects of such things as group dynamics, personal attitudes, and topical content of the communication. In a situation such as this, there is the constant danger of simplifying the "real world" to meet the limitations of the laboratory. However, a review of ongoing laboratory work is quite rewarding.*

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*A more detailed analysis of such research is given in Johansen, Miller, and Vallee, "Group Communication through Electronic Media", *Educational Technology* (August 1974). Also in: *The Delphi Method: Techniques and Applications*, M. Turoff and H. Linstone, eds., Massachusetts: Addison-Wesley Publishing Company (in press).

MAJOR TYPES OF STUDY

ORGANIZATION	Controlled Laboratory Experiments	Field Tests			Survey Research	System or Mathematical Models
		Quasi-Experiments	Purposive Tests	Open-Ended Tests		
IDA	▨		▨			
CSG	▨			▨	▨	▨
Bell Labs	▨	▨				
Chapanis	▨					
Human Sciences Research					▨	▨
Bell Canada				▨	▨	
British Columbia Telephone				▨		
Weston/Kristen		▨				
New Rural Society			▨	▨		
AT&T				▨	▨	
Institute for the Future		▨	▨	▨		

Figure 2. Recent Studies by Various Groups Studying Communications Media

Bell Laboratories, for example, has produced much work in communications research* using variations in experimental methodology. Ongoing work at Bell Labs is now concentrating on the behavioral dimensions of two-person, face-to-face communication, with an eventual goal being the development of a procedure for comparing and evaluating different media of communication.**

At The Johns Hopkins University, Alphonse Chapanis has been doing laboratory research "aimed at discovering principles of human communication that may be useful in the design of conversational computers of the future".*** Chapanis has done a series of laboratory experiments comparing audio, handwritten, teletypewritten, and face-to-face communication. The tasks were carefully selected to be credible "real-world" situations, but the two communicators were always identified as "seeker" and "source". Thus, the experiments actually used information-seeking and information-giving tasks.****

Another recent set of experiments which are relevant to research on group communication media was performed by Klaus Brockhoff, et al., at the University of Kiel, Germany.***** Using bank employees as subjects, Brockhoff conducted inquiries in the areas of finance, banking, stock quotations, and foreign trade. Among the independent variables measured for effect on group performance were medium (face-to-face vs. computer), group size (in the range 4-11), organizational structure (open-ended discussion vs. Delphi), individual expertise as measured in various ways, and question type (forecasting vs. almanac-data). Unfortunately, Brockhoff's work

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*E.g., Claude E. Shannon and Warren Weaver, *The Mathematical Theory of Communications*, Urbana, Illinois: University of Illinois Press (1949).

**See J. Douglas Carroll and Myron Wish, "Multidimensional Scaling: Models, Methods, and Relevance to Delphi", in Murray Turoff and Harold Linstone, eds., *The Delphi Method: Techniques and Applications* (in press).

***Alphonse Chapanis, "The Communication of Factual Information through Various Channels", *Information Storage and Retrieval*, Vol. 9, p. 215.

****The classification of tasks is an essential problem in the research of media for group communication. Though no standard typology has yet been adopted by the entire field, the Communications Studies Group has developed one framework called Description and Classification of Meetings (DACOM).

*****Klaus Brockhoff, et al., *The Performance of Forecasting Groups in Computer Dialog and Face-to-face Discussion*, unpublished.

provides no clearcut findings regarding the independent variable of medium (the most germane to our work with FORUM), since it was varied simultaneously with organizational structure (i.e., the computer medium was used only with the Delphi structure, and face-to-face only with open-ended discussion).

It should be noted that the majority of laboratory experiments involving communication processes have typically concentrated on two-person communication with clearly defined tasks. Thus, time to solution of the task is often a major criterion. Also, some of the inherent problems of simulating the "real world" in a laboratory arise from the lack of continuity in this environment. These factors raise validity questions about the experimental approach, although it certainly has its appealing aspects, including the high degree of control and the ability to isolate key factors.

2. Field Tests

In order to clarify the distinction between laboratory and field tests, we should consider briefly the theoretical characteristics of a quasi experiment:

> "There are many natural social settings in which the research person can introduce something like experimental design into his scheduling of data collection procedures (e.g., the *when* and *to whom* of measurement), even though he lacks the full control over the scheduling of experimental stimuli (the *when* and *to whom* of exposure and the ability to randomize exposures) which make a true experiment possible. Collectively, such situations can be regarded as quasi-experimental designs."*

For our purposes here, field tests are defined as explorations of actual, "real-world" situations with a minimum of experimental manipulation. In this sense, they are quasi experiments, though considerations such as randomized sampling are usually not involved. Thus, in general terms, some of the techniques of the laboratory are applied under less controlled circumstances.

Such a field experiment in electronically mediated group communications was performed at Carleton University (Ottawa, Canada) under the auspices of

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*Donald T. Campbell and Julian C. Stanley, *Experimental and Quasi-Experimental Designs for Research*, Chicago: Rand McNally (1963), p. 34.

the Department of Communications, Canada. Jay Weston and Christian Kristen were the principal investigators in this direct comparison of three communications media (face-to-face, audio, and video), which were used as a basic part of the pedagogy in a human communications course.* Our research has revealed very few comparable efforts at analysis of group communication through alternative media. Thus, this effort should become an important prototype.

Another example of the field test approach is that applied by the British Columbia Telephone Company in their initial tests of the Confravision system for video conferencing. This system, given the same name as that used by the British Post Office, provides live television links between two conference rooms located in Vancouver and Victoria. Under the direction of Anders Skoe, a process for initial field tests was developed and implemented before the system was to be made generally available. In this way, the British Columbia Telephone Company group hoped to begin assessing the behavioral impact of the medium on the people who would be using it. Also, this behavioral goal was linked to initial technical tests of the system and longer-range socioeconomic forecasts.**

An important characteristic of field tests is the ability to run them over a long period of time. Thus, the credibility of the test improves since it is conducted with a sense of continuity and integration with everyday experiences. One example of such a field test is that being conducted by the New Rural Society Project in Stamford, Connecticut. In this case, two banks, located in Stamford and New Haven, are connected via an audio conferencing system with a studio at each location. The time period for the test is six months, and a battery of questionnaires has been developed to assess both user expectations of the system and user reactions at various points in time.

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*J. R. Weston, *Teleconferencing and Social Negentropy,* presented to International Communication Association, Montreal, Quebec (April 1973), p. 8. See also, J. R. Weston and C. Kristen, *Teleconferencing: A Comparison of Attitudes, Uncertainty and Interpersonal Atmospheres in Mediated and Face-to-Face Group Interaction,* The Social Policy and Programs Branch, Department of Communications, Ottawa, Canada (December 1973).

**Personal correspondence from Anders Skoe, sociological analyst, British Columbia Telephone Company, (25 September 1973).

The field test approach, then, attempts to apply experimental research procedures to the degree to which they can be effectively used in the real world. Though the controls are limited, the goals are to produce a maximum amount of systematic data in actual group communication situations. These field tests can vary from quasi experiments, which have a higher degree of control over variables, to more open-ended kinds of interaction.

3. Survey Research

The basic tools of survey research are questionnaires and interviews. In communications research, unique problems are added to the [illegible] of the survey researcher. For example, subjects might be asked to articulate their needs for media which they have not yet experienced. Still, the techniques of survey research remain basic to social science research and can be used creatively to gather information on both reactions to existing media and speculations about future needs.

A good example of survey techniques in telecommunications research is a study by Dean Havron and Mike Averill which had as its goal "the devising a plan and instrument for a survey of needs of Canadian Government managers for teleconference facilities and equipment".* Toward this goal, Havron and Averill designed a questionnaire which they administered to potential teleconference users, asking them a series of questions related to their present conferencing style and the possibilities for employing teleconferencing.

A similar project was directed by James Kollen of Bell Canada** and was focused on existing travel patterns between Montreal, Quebec City, Ottawa, and Toronto. A questionnaire administered to businessmen travelling between these cities sought to determine why respondents felt they needed to travel (rather than use alternative communications media) to complete their objectives. In this case, the overall purpose of the project was to explore the

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*M. Dean Havron and Mike Averill, "Questionnaire and Plan for Survey of *Teleconference Needs Among Government Managers*", prepared for the Social Economic Branch, Department of Communications, Canada, [illegible] (30 November 1972), p. 1.

**See James H. Kollen, "Transportation-Communication Substitution Study: A Research Proposal", Bell Canada (February 1973).

possibilities for substituting electronic communication for travel in interurban exchanges.

Dean Havron, with Anna E. Casey-Stahmer, was also involved in a project which used survey techniques to assess existing telecommunications systems.* In an effort to establish a general approach to research in teleconferencing, they developed a grid to classify teleconferencing system dimensions and characteristics through information gathered in interviews with actual users.

The techniques of survey research are certainly relevant to the social evaluation of communications media and are frequently employed, even in more controlled situations such as those mentioned earlier.

CSG, IDA, and FORUM Research

In 1970, the Communications Studies Group, which we shall designate simply as CSG, was founded in London, England, with direct support from the British Civil Service Department and Post Office. CSG has now become a major center of telecommunications research, building primarily on a laboratory experiments style, but also using nearly all relevant research styles.** The group has completed more than 75 studies of various aspects of media usage, concentrating particularly on the effects which alternative media (face-to-face, audio, and audio-plus-video) have on group problem-solving effectiveness and user satisfaction.***

Among the principal findings of CSG is the observation that the choice of medium affects conference outcome significantly only if the task is one for which interaction is necessary and personal relationships are relevant to the outcome (e.g., negotiationor interviewing, but not information exchange or problem-solving). CSG has also found that acceptability of a new medium is strongly influenced by such factors as location of equipment, the way in which the medium is introduced to new users, the extent to which present communications requirements are satisfied, and the ease of use and reliability of the new equipment. Acceptability also appears to be dependent on task type, with all three media being acceptable for problem-solving and information exchange while only face-to-face (and video to some extent) is suitable for meetings involving personal relations or conflict. CSG has gathered some data on relative costs of alternative media and on probable impact on feasible office locations; in this area, the group's tentative finding is that narrow-band telecommunications (i.e., audio) offer considerably wider possibilities than the much more expensive video systems.

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*Casey-Stahmer and Havron, op. cit.

**One of the approaches which was pursued early in the CSG work was that of mathematical modeling toward what was called the "Telecommunications User Impact Model". These efforts have been postponed now and suggest that the present state of research involving group communication through electronic media is not sufficiently developed to justify the application of mathematical modeling techniques. Our own experience supports such an appraisal, though some efforts (such as those of A. J. Seyler) continue to explore possibilities in this area.

***They have also done some media development, the clearest example being the Remote Meeting Table (RMT) system which is now in operation in Great Britain. This system was designed for group audio conferencing, with connection between multiple meeting rooms, each of which is equipped with microphones and speakers around a circular table (CSG *Final Report*, 1973).

One other important source of research methodology has contributed to the development of our work with FORUM. This is the work of the Institute for Defense Analyses (IDA), which began in the early 1960s. One of the first organizations to consider teleconferencing research directly, IDA focused on the possible use of such communications media as telephone, teletypewriter, and/or television in international relations. Of special interest was the potential for using teleconferencing in crisis-negotiation situations.

The theoretical work done by the IDA is still instructive for research design involving group communication. Figure 3 shows the key elements identified in these studies. IDA's approach included simulated crises in laboratory situations and field tests using different combinations of media. This series of studies, which has only recently been released to the general public, can be considered a methodological forerunner of the work which is described in this report.*

Building on the methodological foundations provided by these ongoing studies, our own work has moved toward a model for field experimentation.

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*Gerald Bailey, Peter Nordlie, and Frank Sistrunk, *Literature Review, Field Studies, and Working Papers*, Research Paper P-113, Institute for Defense Analyses (October 1963), p. 2.

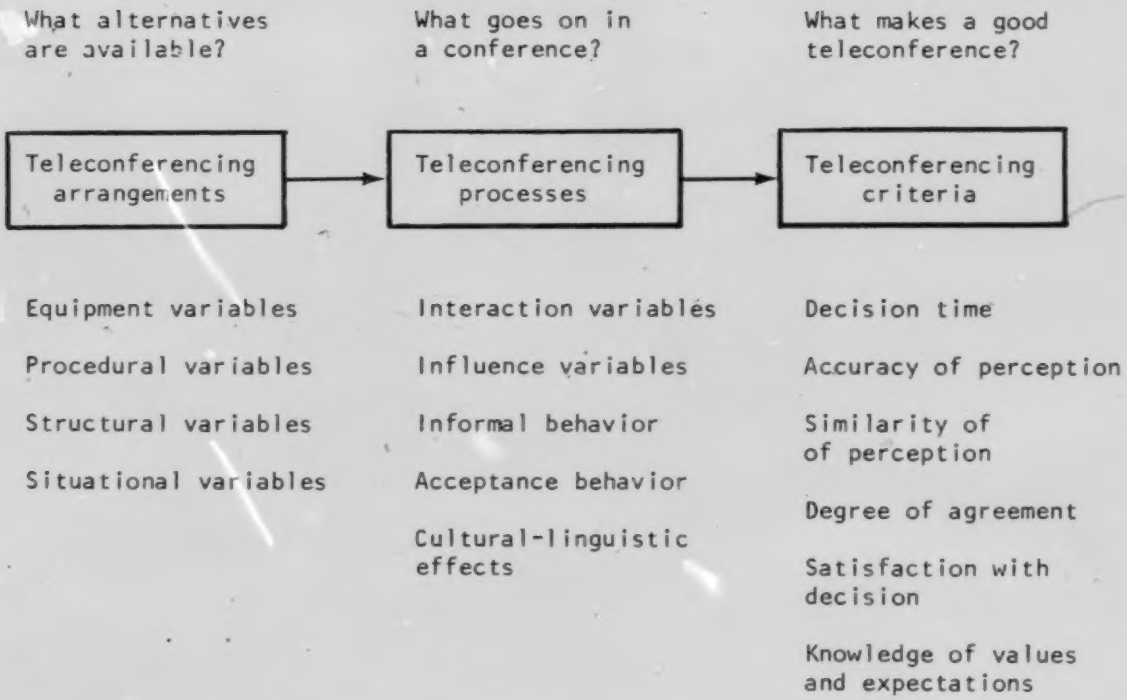
What alternatives are available?
What goes on in a conference?
What makes a good teleconference?
Teleconferencing arrangements
Teleconferencing processes
Teleconferencing criteria
Equipment variables
Procedural variables
Structural variables
Situational variables
Interaction variables
Influence variables
Informal behavior
Acceptance behavior
Cultural-linguistic effects
Decision time
Accuracy of perception
Similarity of of perception
Degree of agreement
Satisfaction with decision
Knowledge of values and expectations

Figure 3. Typical Predictive System for the Experimental Study of Teleconferencing*

with limited [illegible] we have attempted to [illegible] tematic data in [illegible] communication [illegible] which is described in [illegible] taxonomy for group communication, attempting to [illegible] potheses about network configuration, [illegible] best suited to [illegible]

---

*From the IDA teleconferencing studies; Bailey, Nordlie, and Sistrunk, op. cit., pp. 1-19.

B. Toward a Taxonomy for [illegible]

Any one of the several approaches [illegible] tory experiments [illegible] some purposes, [illegible] more basic than the [illegible] onomy which can be [illegible] complete [illegible]

The existing [illegible] communication between two persons [illegible] ber of experiments have been [illegible] these have dealt with the [illegible] an individual [illegible] electronic media with a [illegible] patterns in group [illegible] ply cannot be assumed [illegible]

Our examination of the [illegible] taxonomy has been developed [illegible] context of the [illegible] has carefully [illegible] lation in the [illegible] lation problems, [illegible] into independent [illegible]

---

*Examples include the [illegible] Graphic System, [illegible] Audio-Video Teleconferencing System [illegible] Havron, [illegible] ference System, [illegible]

**Bailey, [illegible], and [illegible]

crises, and social determinants), intervening variables (e.g., interaction process), and criterion variables (e.g., group satisfaction and group outcome).*

Our initial attempt to construct a taxonomy has been similar to the IDA effort, but has not assumed the crisis orientation. Also, our efforts so far have not treated the dynamic aspects of the communication, but have concentrated instead on the elements in a communication situation *before* the interpersonal process begins (see IDA's category "Teleconferencing Arrangements"). Our first, partial taxonomy (shown in Figure 4) has thus been arranged to suggest a varied weighting among five key factors, none of which will be completely discrete. For instance, if members of a given group have a very high need to communicate, they are more likely to make appropriate efforts to gain access to any medium, even if it is difficult to use or unfamiliar to them. Conversely, familiarity with a particular medium is likely to be a very important factor in the choice of that medium for practical communication.

In addition to our own initial taxonomy of preconference factors, we are aware of several other taxonomic efforts which are potentially relevant to FORUM. For example, Rudy Bretz has constructed a taxonomy of communications media which he divides into eight classes according to the coding process which is being employed for sending messages (e.g., audio/motion/visual, audio only, print only, etc.). Having established this taxonomy, he then traces the necessary decision points in making a choice of the simplest medium available to fill a specific instructional need. Using the taxonomy suggested in this report, his decision would be based within the sections labeled "Medium" and "Task". The dimensions of "Person", "Group", and "Rules" are thus not included in the Bretz taxonomy.**

Another approach to selection of media for instruction was developed by C. Edward Cavert.*** His very usable technique operates from a matrix

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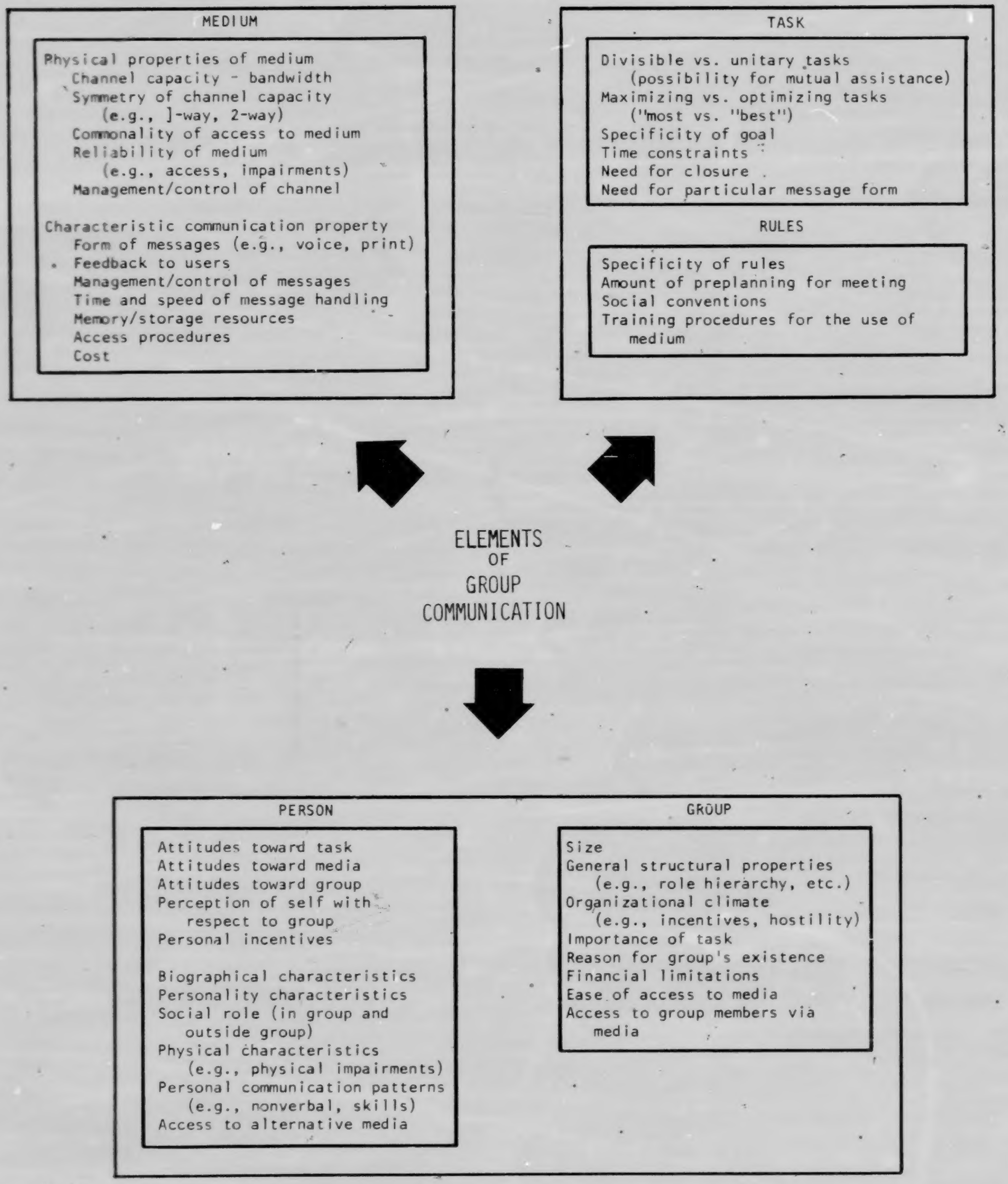
*Bailey, Nordlie, and Sistrunk, op. cit., p. 14.

**Rudy Bretz, *The Selection of Appropriate Communication Media for Instruction: A Guide for Designers of Air Force Technical Training Programs*, Report R-601-PR, The Rand Corporation (February 1971), p. 30 ff.

***See C. Edward Cavert, *Procedures for the Design of Mediated Instruction*, State University of Nebraska Project (1972).



MEDIUM

Physical properties of medium
  Channel capacity - bandwidth
  Symmetry of channel capacity
    (e.g., 1-way, 2-way)
  Commonality of access to medium
  Reliability of medium
    (e.g., access, impairments)
  Management/control of channel

Characteristic communication property
  Form of messages (e.g., voice, print)
  Feedback to users
  Management/control of messages
  Time and speed of message handling
  Memory/storage resources
  Access procedures
  Cost

TASK

Divisible vs. unitary tasks
  (possibility for mutual assistance)
Maximizing vs. optimizing tasks
  ("most vs. "best")
Specificity of goal
Time constraints
Need for closure
Need for particular message form

RULES

Specificity of rules
Amount of preplanning for meeting
Social conventions
Training procedures for the use of
  medium

ELEMENTS OF GROUP COMMUNICATION

PERSON

Attitudes toward task
Attitudes toward media
Attitudes toward group
Perception of self with
  respect to group
Personal incentives

Biographical characteristics
Personality characteristics
Social role (in group and
  outside group)
Physical characteristics
  (e.g., physical impairments)
Personal communication patterns
  (e.g., nonverbal, skills)
Access to alternative media

GROUP

Size
General structural properties
  (e.g., role hierarchy, etc.)
Organizational climate
  (e.g., incentives, hostility)
Importance of task
Reason for group's existence
Financial limitations
Ease of access to media
Access to group members via
  media

Figure 4. Identification of Elements in a Group Communication Situation (before Process Actually Begins)

showing available media on one axis, with a modification of Bloom's taxonomy of learning on the other axis. (Bloom's taxonomy is a well-known technique for classifying types of learning, from rote memorization to ability to apply knowledge in new contexts.) Cavert then suggests that each available medium be matched to the level of learning for which it seems most appropriate and that the overall media strategy of a school include a distribution of available media across types of learning. Thus, he has developed a simple technique for assessing the general choices of media for various needs within some overall design.

Another basic taxonomy, which differs somewhat in its approach to media, is that developed by Fred Lakin.* This taxonomy functions as a coding sheet which includes a general format for classification and possible exceptions. Though this approach is not yet developed for choice among media, it represents a good general format which is quite practical for initial classifications of media.

With such a variety of incomplete, but possibly useful taxonomies, it was necessary to attempt a synthesis. With this goal in mind, we sponsored a small workshop devoted to the clarification of these issues at the Institute for the Future in February 1974.** For this group, "taxonomy" meant a logical structure through which fundamental elements of group communication could be classified. "Medium" assumed a loose definition which included face-to-face communication. The issues in creating a taxonomy were identified as:

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*See Fred Lakin, *Media for A Working Group Display* (available from Fred Lakin, 218 Waverley Street, Palo Alto, California 94301).

**The participants in this workshop were: Garth Jowett, Department of Communications, Canada; Lee McMahon, Bell Laboratories; Martin Elton, Communications Studies Group; Jay Weston, Carleton University; Christian Kristen, University of Montreal; Robert Johansen, Richard Miller, and Jacques Vallee, Institute for the Future; George Jull and James Craig, Communications Research Center, Canada; Mike Averill, National Film Board of Canada; Tony Niskanen, Arthur D. Little, Inc.; and Dean Havron, Human Sciences Research, Inc. The workshop group was kept small in order to promote maximum interaction and thus did not include everyone doing key research in this field. However, it was hoped that this initial face-to-face workshop would build the basis for broader exchange of research approaches and results.

- Defining essential elements in a group communication situation;
- Determining an appropriate level of abstraction for discussing these elements;
- Fitting these elements into a formal structure;
- Drawing boundaries around key factors; and
- Testing the resulting structure on real situations.

The discussion led to a general agreement that static frameworks for analysis may have been pushed too far in existing research. A taxonomy must be able to describe a communication situation in fundamental terms, and perhaps the most fundamental characteristic of communication is that it goes on *over time*. Thus, descriptors of a communication situation may be less important than the general *states* of the group before and after communication occurs. A viable taxonomy must consider not only the meeting of persons in a communication situation, but the relation of this meeting to larger processes. In the past, research has often focused on what *can* be measured, though the things which are hardest to measure could actually be the most important.

Figure 5 shows the working taxonomy which the workshop developed. It incorporates the elements of group communication into an overall process of communication through time. Any meeting is itself considered an "episode" in an ongoing communication process. The problem, of course, is the development of techniques for analyzing and comparing state variables after these have been identified as important.

The workshop was therefore successful in beginning a dialogue among active research groups and in identifying an overall taxonomy which seems compatible with differing research philosophies.

In our future taxonomic efforts, more attention will, of course, have to be given to group dynamics. With the exception of experiments involving conference telephone,* little consideration has been given to the theoretical (i.e., in terms of taxonomy) or behavioral aspects of group interaction

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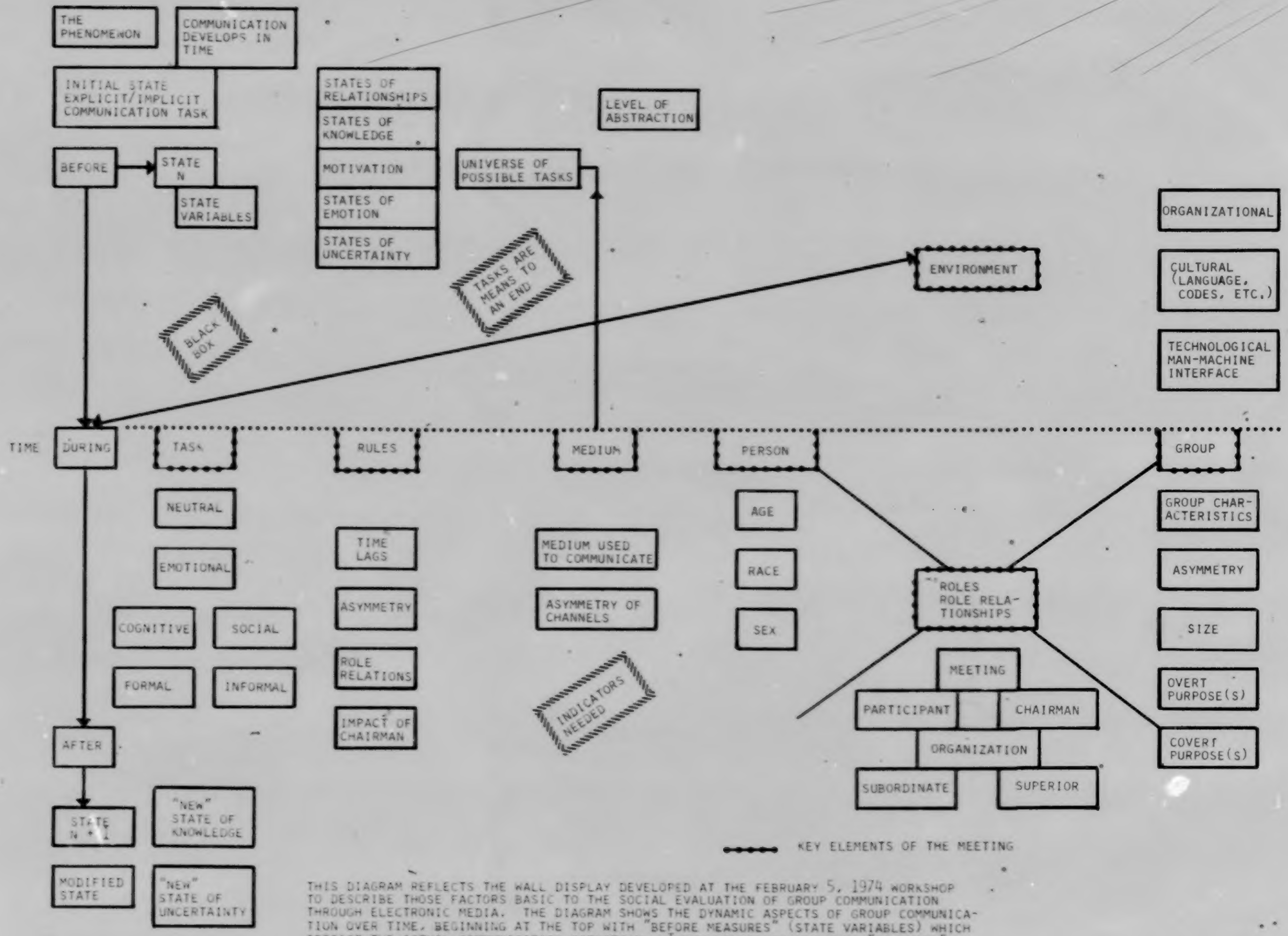
*See Communications Studies Group, *Progress in Current Experiment*, W/71132/CH (1971); Communications Studies Group, *Bargaining at Bell Laboratories*, E/71270/CH (1971); and Casey-Stahmer and Havron, op. cit.


THE PHENOMENON
COMMUNICATION DEVELOPS IN TIME
INITIAL STATE EXPLICIT/IMPLICIT COMMUNICATION TASK
BEFORE
STATE N
STATE VARIABLES
STATES OF RELATIONSHIPS
STATES OF KNOWLEDGE
MOTIVATION
STATES OF EMOTION
STATES OF UNCERTAINTY
UNIVERSE OF POSSIBLE TASKS
LEVEL OF ABSTRACTION
TASKS ARE MEANS TO AN END
BLACK BOX
ENVIRONMENT
ORGANIZATIONAL
CULTURAL (LANGUAGE, CODES, ETC.)
TECHNOLOGICAL MAN-MACHINE INTERFACE
TIME
DURING
TASK
RULES
MEDIUM
PERSON
GROUP
NEUTRAL
EMOTIONAL
COGNITIVE
SOCIAL
FORMAL
INFORMAL
TIME LAGS
ASYMMETRY
ROLE RELATIONS
IMPACT OF CHAIRMAN
MEDIUM USED TO COMMUNICATE
ASYMMETRY OF CHANNELS
INDICATORS NEEDED
AGE
RACE
SEX
ROLES ROLE RELATIONSHIPS
MEETING
PARTICIPANT
CHAIRMAN
ORGANIZATION
SUBORDINATE
SUPERIOR
GROUP CHARACTERISTICS
ASYMMETRY
SIZE
OVERT PURPOSE(S)
COVERT PURPOSE(S)
AFTER
STATE N + 1
MODIFIED STATE
"NEW" STATE OF KNOWLEDGE
"NEW" STATE OF UNCERTAINTY
KEY ELEMENTS OF THE MEETING

THIS DIAGRAM REFLECTS THE WALL DISPLAY DEVELOPED AT THE FEBRUARY 5, 1974 WORKSHOP TO DESCRIBE THOSE FACTORS BASIC TO THE SOCIAL EVALUATION OF GROUP COMMUNICATION THROUGH ELECTRONIC MEDIA. THE DIAGRAM SHOWS THE DYNAMIC ASPECTS OF GROUP COMMUNICATION OVER TIME, BEGINNING AT THE TOP WITH "BEFORE MEASURES" (STATE VARIABLES) WHICH PREFACE THE ACTUAL COMMUNICATION SITUATION. THESE VARIABLES ARE THEN "FILTERED" THROUGH THE COMMUNICATION SITUATION (THE ELEMENTS OF WHICH ARE IDENTIFIED IN FIGURE 4 AND ARE DISPLAYED HERE ALONG THE DOTTED LINE) TO PRODUCE SOME MODIFIED STATE VARIABLES.

Figure 5. Expansion of Taxonomy in Figure 4 to Incorporate the Dynamic Aspects of Group Communication over Time

solely by means of a teleconferencing medium. This situation is analogous to the three-body or *n*-body problem in physics: a description of two-body interactions reveals little about three-body or *n*-body interactions. Similarly, little research besides the communication network studies by Bavelas or Smith and Leavitt has dealt with any of the behavioral or theoretical aspects of the *n*-body problem of communications. The introduction of "participation maps" in the analysis of FORUM conferences represents one attempt at describing this interaction.

Future research with computer-assisted media such as FORUM demands investigation of this *n*-body problem since the typical scenario includes several users, each connected to others by means of a terminal. The peculiarities of computer conferencing do not allow a facile transfer of theoretical or behavioral findings to other media due to differences in (a) time and synchronicity of interaction, and (b) the fact that interaction takes place through a keyboard. Since it seems evident that the interaction of three or more individuals by means of different electronic media is affected by the limits and constraints of technology and human engineering, the problems of *n*-body communications should be a high priority subject for future investigation.

Another technological consideration in studying group interaction via electronic media is "medium memory"; that is, the capability of a medium to produce a record of an interaction and to make the record available to the user. Information theory and communication theory have often dealt with "channels with memory", but *only* on a technological/engineering basis. The various *behavioral* aspects of "medium memory" (for example, its presence or absence, its availability to users, and the extent of the record) may be significant in the use and perception of teleconferencing media; these aspects must be examined in future research.

C. TYPES OF HYPOTHESES

Parallel to the Institute's taxonomy development effort was an attempt to generate and classify hypotheses or statements about network conferencing based on current experience with FORUM and knowledge of small-group research.

As part of this effort, a typology of hypotheses was developed in the following way:

Consider statements of the form: "FORUM has property P". These may be crudely classified in two ways. "Type 1 statements" are statements of fact deriving from the implementation of the system and demonstrable in *physical* terms. An example might be: "FORUM enables remote users to exchange alpha-numeric messages." We use the term "Type 2 statements" for those assertions about FORUM that derive from its nature but are only demonstrable in *social* terms. For instance, the statement that "FORUM enables remote users to engage in joint authorship" may be true physically but false in social terms if the system is not perceived as useful by the authors.

Many statements about FORUM, however, fall outside of Types 1 and 2, leading to an extension of this classification system. They are of the form: "FORUM has property P when compared to medium X". An example would be the statement that "FORUM leads to better recall than face-to-face interaction". Such statements have been classified as Type 3 statements.

Finally, some statements, which we have called Type 4 statements, are simple assertions of facts concerning human or group behavior and can be assumed to be medium-independent, although it may be necessary to test them under computer conferencing conditions to prove the point. Example: "Groups under stress function better when strong leadership is present."

Six researchers at the Institute used the FORUM system itself to propose hypotheses to be classified in this fashion in the course of an "Experimental Design Conference". Altogether, 267 hypotheses about FORUM were generated *anonymously* in this fashion.* The statements were taken from the transcript and transferred onto cards for convenient sorting. The deck of cards was then circulated among the staff for a "secret ballot" allocation of types to hypotheses. The resulting distribution was the following:

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*Anonymity as a desirable feature in group communication through computers was first introduced in the Delphi context. FORUM supports an anonymous mode through which participants can make entries into the record without being identified.

Type 1: 3 hypotheses
2: 83
3: 30
4: 146

This unconventional approach to hypothesis generation, using FORUM itself to stimulate the expression of hypotheses about FORUM, was a complement to (and a release from) the more classical process of theoretical exploration which was described in the earlier sections of this chapter. The technique appeared to broaden the scope of research design.

After hypotheses and statements were identified and categorized, we turned to a determination of the experimental mode best suited to each type of hypothesis. Given the basic research approaches (laboratory experiments, field tests, surveys, and possibly models), we arranged the types of hypotheses and the experimental modes as shown in Figure 6. Type 1 hypotheses can be easily tested in a laboratory environment and do not concern the social effects of the medium. Type 2 hypotheses (our focus in the initial phase) need to be tested in the context of field tests before specific aspects of the activity can be brought into the laboratory; such field tests may be quasi experiments, purposive tests, and open-ended tests. We have emphasized purposive and open-ended tests in our research.

Type 3 hypotheses follow the same pattern as Type 2 to the extent that they mainly involve task- and group-related hypotheses. When they involve the medium as a major variable, a laboratory environment is often necessary. Such testing is currently beyond the scope of our investigations, although we have developed an experimental approach to specific hypotheses in this domain and may implement it at a later date.

Type 4 hypotheses will require re-examination in terms of possible assignment in categories 2 and 3, with suitable rephrasing of the conditions of the hypothesis. It can be observed in Figure 6 that some overlap exists between Types 2 and 4. The resulting assignment is often a function of the precision with which the premises of the hypothesis have been stated.

Given this variety of hypotheses, classifications, and possible designs for experiments, the next questions for our investigation were: What factors

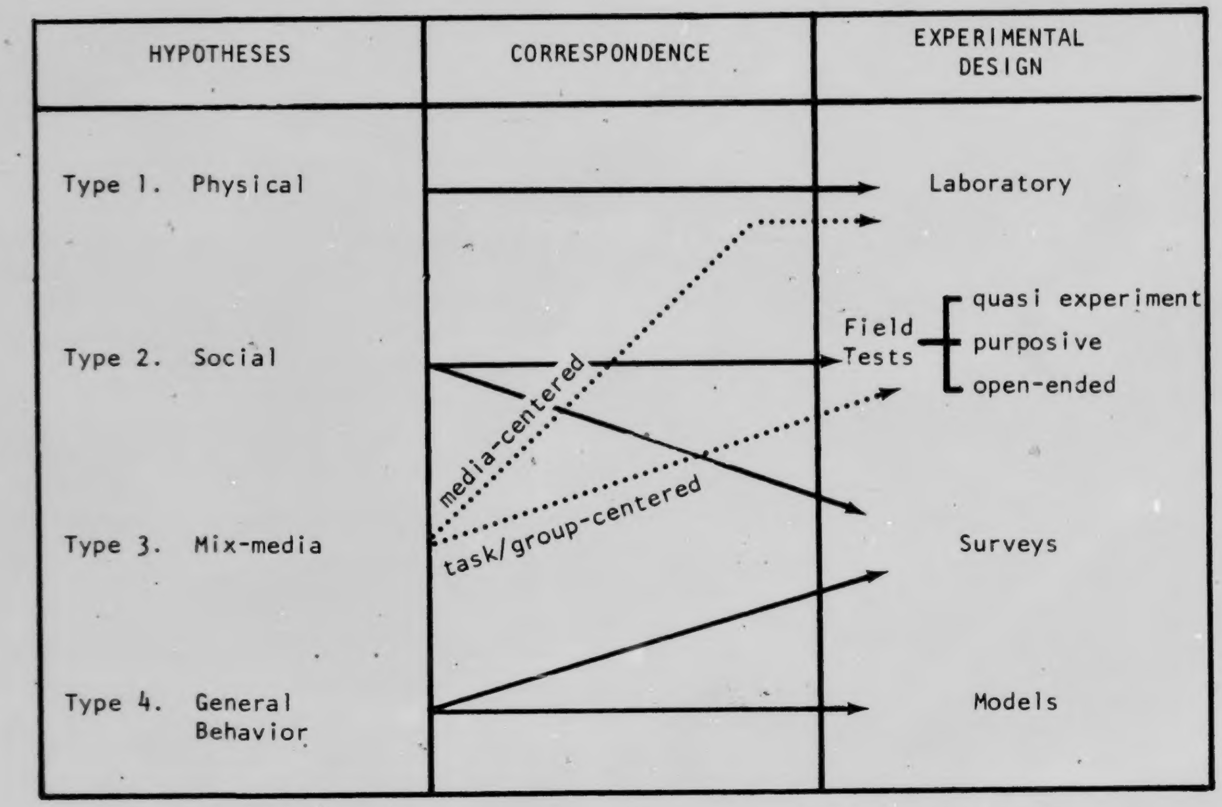
HYPOTHESES
CORRESPONDENCE
EXPERIMENTAL DESIGN
Type 1. Physical
Type 2. Social
Type 3. Mix-media
Type 4. General Behavior
media-centered
task/group-centered
Laboratory
Field Tests
quasi experiment
purposive
open-ended
Surveys
Models

Figure 6. Experimental Approaches Corresponding to Four Types of Hypotheses

and variables need to be measured? How will they be measured? What statistics should be obtained from the computer itself? What new tools can be introduced to describe and analyze the teleconference transcript? These are the questions of measures, and they present unique difficulties in this area of study.

D. MEASUREMENT TOOLS

Measures which might be used to evaluate FORUM conferences are closely tied to its characteristics as a medium of communication. Though a taxonomy may identify key elements, the weightings among these factors will frequently be unknown or imprecise. Also, there will frequently be factors external to the FORUM conference which are inaccessible to conventional measurement techniques. Given the mix of relevant variables (e.g., group dynamics, user profile factors, varied purposes for teleconferencing, system reliability, etc.), it quickly becomes clear that no single conference will reveal all of the fundamental social characteristics of computer conferencing.

A starting point is the identification of the basic characteristics of FORUM as a communications medium. Our taxonomy of teleconferencing arrangements has made it clear that FORUM cannot be treated as a clearly defined, independent variable isolated from confounding variables. Still, it is possible to list some of FORUM's basic characteristics:

- Communication is possible through computer terminals only.
- The transcript of proceedings is always available.
- The user can participate in several conferences simultaneously.
- The medium is self-activated: the user takes the iniative to use it at a time when he chooses; delayed and/or real-time conferencing thus becomes possible.
- Varied group structures are possible, from open discussion to questionnaire.
- An unfamiliar social environment is created; exact characteristics are uncertain.

Given these characteristics, it is then possible to list measurement techniques which could be used as assessment tools. These include user statistics, context-related measures, questionnaires, psycholinguistic measures, user profiles, and other general measures.

The possibilities for measurement may be categorized according to a matrix which identifies the "measurer" (that could be a computer) and the target of the measures (see Figure 7). In this matrix, the "automaton" is a FORUM Reporter program which monitors the conference interaction. This mechanism provides accounts of the measures listed under that heading, though it does not have access to the content of messages. The human/computer combination would typically rely upon computer identification of specific types of text and human coding of that text. This involves machine monitoring which provides specific information, on line, to a human coder for his/her judgment (e.g., content analysis of each user input).

The typology presented in this matrix is directed toward computerized conferencing as a single medium. Later applications might also involve combinations of computerized conferencing, audio, and/or visual links. When these dimensions are included, the measures shown here will need to be expanded and the classification modified.

We have not attempted to apply all of these measurement techniques to the analysis of FORUM conferences. Instead, we have used specific combinations of approaches. The analysis of FORUM conferences can best be performed by applying several techniques to the same conference in this "multiple measures" approach. The relationship among the results can then provide useful information on the validity of the overall analysis.

MEASURED BY WHOM?

TO WHOM DO THE MEASURES APPLY?	AUTOMATON	HUMAN/COMPUTER COMBINATION	HUMAN ANALYSIS
COMPUTER	CPU usage/conference Connect time/CPU usage Connect time/conference Disk access Cost in CPU, core, disk/each conferee System response time		User evaluation of system operation
INDIVIDUAL	Inputs/conferee Errors/conferee Commands/conferee Editing commands/conferee User response times Length of comments # of private messages sent and received # of anonymous messages Amount of connect time/conferee Sequence of errors	Physiological factors during FORUM sessions	Self-evaluation of FORUM sessions User evaluation of system operation Bales' indices from "Interaction Process Analysis" Direct access to resources Indirect access to resources Generalized status index Index of control over situation Directiveness of control Familiarity with computers Typing ability Age Expectations of FORUM Attitudes toward group Attitude toward task
GROUP	Inputs/conference Errors/conference # of each type of error Command requests/conference Editing commands/conference Time between each input Length of comments # of private messages # of anonymous messages Amount of connect time/conference Sequence of errors	Communication patterns Analysis of content Attention profile Psycholinguistic measures: Semantic differential Adjective checklist Free-association Type-token ratio Rate of verbal output Tense analysis	Categorization of prior and subsequent comments Index of difficulty of communication Index of expressive/malintegrative behavior Index of total differentiation Contingency analysis "Survey of Organizations" approach (CRUSK) Communication patterns Affective language Attention profile Achievement of end results References to previous inputs Psycholinguistic measures Word frequency measures Topic classification Overall subjective evaluation

Figure 7. Measurement Tools

III. THE ANALYSIS OF COMPUTER CONFERENCES

III. THE ANALYSIS OF COMPUTER CONFERENCES

A. OVERVIEW OF RESEARCH PROGRAM

In the course of this project, we have had the opportunity to observe the behavior of small groups of up to forty participants during the period from June 1973 to April 1974. Among the conferences held by these groups, ten are of significant interest in the context of our research, either because they were intended for preliminary evaluation of particular hypotheses or because their size, duration, or topic made them especially relevant to our study of computer conferencing in general. It should be noted that although FORUM has the ability to provide a number of possible structures for conferencing,* the conferences in this phase of the research have been relatively unstructured. That is, structures such as computerized questionnaires or votes were not performed by FORUM as part of the conference structure--even though this capability is present.

For convenience, we have labeled the conferences described in this report C1 through C10. Some basic information about each is listed in Table 1.

The participants in all conferences became aware of the availability of FORUM either through direct contact with members of the Institute staff or by reading articles describing the system. Participation was decided on the basis of *their interest in using FORUM in the course of their own work*. Participants were not recruited for the purpose of specific experiments and were not paid. They usually provided their own terminal equipment and phone communications. Only two conferences (C2 and C3) were restricted to the staff of the FORUM project; two conferences (C9 and C10) involved no member of the FORUM staff. Brief descriptions of each of the ten conferences follow:

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*See Lipinski, H. M., and R. H. Miller, "FORUM: A Computer-Assisted Communications Medium," *Proceedings of the Second International Conference on Computer Communication*, Stockholm (August 1974).

No.	Name	Active* Participants	Duration (days)	Number of Entries	Purpose of Experiment	User Hours
C1	USGS	9	30	1341	link to data bases	NA
C2	Staff Meeting	8	122	439	effectiveness in research management	81
C3	Experiment Design	7	125	517	effectiveness in research design	64
C4	XYZ	7	51	533	joint planning	NA
C5	WPO	3	27	53	media usage comparison	26
C6	Tradeoff	29	22	1070	technology assessment	304
C7	Users 1	31	120	399	distributed software testing	133
C8	Users 2	21	111	551	joint research activity	89
C9	AWARE	3	18	414	seminar planning	NA
C10	AP	14	166	320	computer science research	279
			Total:	5637		

Table 1. Teleconferencing Field Tests Performed with FORUM (June 1973 to March 1974)

*Active participants are those who have made one or more entries in the conference.

C1. U.S. Geological Survey Conference (June 1973)

The U.S. Geological Survey Conference was designed to test the feasibility of linking computer conferencing with large-scale information retrieval systems. The working environment was that of the U.S. Geological Survey. As the conference utilized FORUM-3, (an earlier program version), no Reporter statistics are available.

C2 and C3. Staff Meeting and Experimental Design (July 1973 - January 1974)

The Institute staff, working on the FORUM project, held a staff meeting conference over a six-month period, with the FORUM medium serving as a continuous communication link, even during hours when the Institute offices were closed. (Four staff members each had a home terminal.) A parallel conference was also created to discuss hypotheses and experiments with FORUM. Preliminary statistical results derived from these conferences have been reported in Volume 1 of this report series.

C4. XYZ Conference (November-December 1973)

A strategic planning conference was held between the Institute for the Future and the staff at an organization which we shall refer to as XYZ. The goal was to investigate the problem of connecting several remote, local groups involved in the planning and coordinating of a major public event. This conference was one of the first tests to deal with a real problem of planning.

C5. Washington State Planning Office (November 1973)

A FORUM conference lasting about thirty days was held between the Washington State Planning Office in Olympia, Washington, and a consultant working with them in Palo Alto, California. The task was the development of a long-range plan for the state, and the conference was used for only one month of a project which lasted about six months. FORUM was used for periodic reports by the consultant, for scenario generation, and for general information exchange.

C6. Travel/Communication Tradeoffs (January 22 - February 11, 1974)

Jointly arranged with Bell Canada, this conference was the second generation of a discussion among researchers which had been conducted in previous years by using conference telephone links. About 35 researchers were involved in this FORUM test, all of whom were in some way engaged in work related to travel/communication tradeoffs. The subject of the conference was the assessment of telecommunications as a substitute for physical travel.

C7 and C8. User Reaction Conferences (October 1973 - February 1974)

These conferences were made available to users who had a specific interest in expressing their reactions to FORUM, in documenting system errors, and in suggesting new features. C7 functioned as a tool for continuous evaluation while C8 was a general discussion of alternative futures for teleconferencing.

C9. Project AWARE (November 27 - December 13, 1973)

When one of the senior staff members at the Institute was recovering from surgery, a conference was arranged to continue his direction of Project AWARE from his home via FORUM. The conference involved three persons who were engaged in planning a seminar, writing letters, assigning tasks, and generally accomplishing the goals of their project during this period when normal interaction among them was impossible.

C10. Automatic Programming Implementation Notes

This field test involved a research group at the Information Sciences Institute of the University of Southern California. The group used FORUM as a collective notepad for communication between task groups and for keeping records of the evolution of a software development project.

Of these ten conferences (which are shown in the field test schedule in Figure 8), the Travel/Communication Tradeoffs Conference (C6) was the most productive from several points of view: it represented the first instance in which complete monitor statistics (as well as questionnaire data) were available. It was also significant in that the proceedings of the

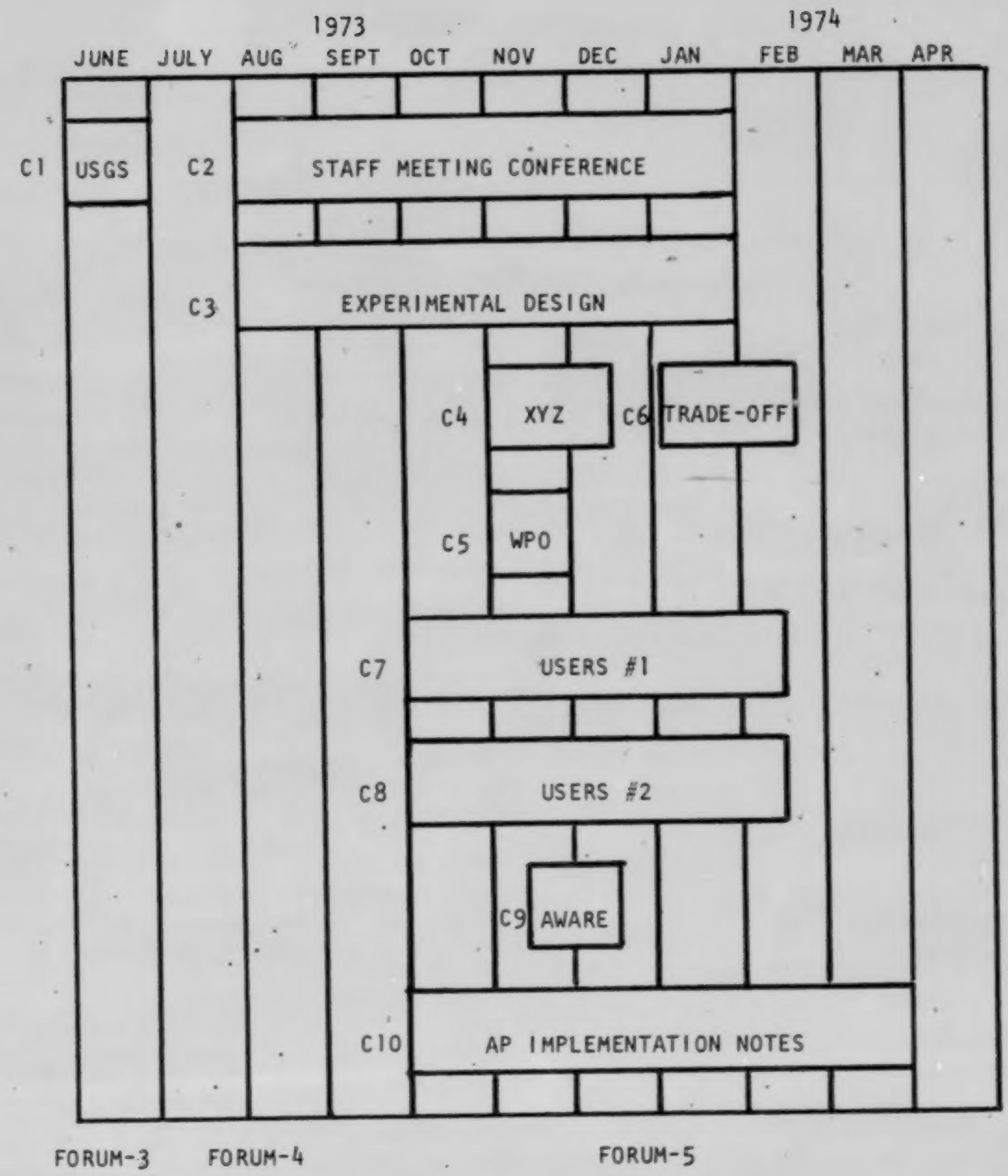
1973
1974
JUNE
JULY
AUG
SEPT
OCT
NOV
DEC
JAN
FEB
MAR
APR
C1
USGS
C2
STAFF MEETING CONFERENCE
C3
EXPERIMENTAL DESIGN
C4
XYZ
C6
TRADE-OFF
C5
WPO
C7
USERS #1
C8
USERS #2
C9
AWARE
C10
AP IMPLEMENTATION NOTES
FORUM-3
FORUM-4
FORUM-5

Figure 8. FORUM Field Test Schedule

conference were of sufficient interest in themselves to deserve publication.* Hence, what began as an exercise in teleconferencing reached the level of a contribution to the field of energy substitution.

Figure 9 summarizes the analysis and measurement techniques that we have applied to the ten FORUM conferences. (Each of these techniques is described in the following sections.) In only one case has strict comparison been possible with the usage of other media by the participants, namely in conference C5. Since the major media used previously by them were the telephone and travel, records were kept of usage patterns both before and during the availability of FORUM. We found no clear evidence that FORUM substituted for telephone usage or travel in this case. However, the log book revealed that the telephone was used for more interactive tasks, while FORUM was used for scenario writing and less urgent exchanges. It is clearly impossible to derive conclusive evidence from this case.

Conference C9 provided another interesting test; it was created by necessity when the leader of a research group at the Institute was recuperating from surgery and had to stay at home for several weeks. A major task of the group at this time was to plan and organize a seminar for industrial clients on the topic of equality of opportunity. Here the project operations were able to continue via FORUM in a situation in which neither face-to-face nor telephone communication would have been satisfactory. A more complete assessment of the user reactions and task performance in this conference is given in Section III-C.

Of special relevance in view of the interest in the cost-effectiveness of computer conferencing is the question of the computer resources utilized in conducting a significant conference in a real-world setting. We have analyzed the "Tradeoffs" conference from this point of view, examining terminal connect time, CPU utilization, and storage costs. A good "round number" for these costs at the present rates for commercial computer networks is about $20 per terminal hour. In Conference C6, there was a total of 304 terminal hours. This is the most accurate figure available, but it is

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	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
LOG BOOK					▨					
INTERVIEWS	▨	▨			▨				▨	
QUESTIONNAIRE					▨	▨				
FORUM REPORTER		▨	▨	▨	▨	▨	▨	▨	▨	▨
MORPHOLOGICAL ANALYSIS				▨		▨				
MICRO-SEMANTIC ANALYSIS				▨						
PARTICIPATION MAP		▨	▨	▨	▨	▨	▨	▨		

Figure 9. Measurement Techniques Applied to FORUM Field Tests

somewhat inflated, since several users left their terminals logged in--even when they were not typing--so they could meet people as they "dropped in". If all of the users had been paying commercial rates, we doubt that this would have occurred. Thus, we estimate that an accurate adjusted figure is about 250 terminal connect hours for actual participation. Multiplying this by the summary cost figure of $20 per hour, we get a total computer cost of $5,000. This figure would not include terminal rentals or telephone charges.

To estimate the cost of a comparable face-to-face meeting is even more difficult. If we assume that the meeting might have been held in a central location (e.g., Chicago) for a period of two days, it is possible to calculate travel and expenses for the participants. Assuming that all 29 persons who made entries in the conference decided to travel to Chicago for the two-day meeting, their total round-trip air fare to Chicago would have been about $7,000. Figuring expenses (hotel, food, etc.) of $45 per day per person, the additional cost would be about $2,600. Meeting place rental and arrangements might bring the total to $10,600. This figure does not include any costs for recording and transcribing the meeting, a task done automatically in a computer-based conference.

The above analysis certainly has very real limitations. For instance, neither figure considers the cost of the participants' time. (Actual time spent would have been considerably lower in the computer-based conference.) However, assuming the difficulties of comparison, the computer-based conference cost about one-half as much as a face-to-face meeting would have cost ($5,000 compared to $9,600). These figures should serve as a starting point for more detailed comparisons which we plan to make in our future research.

B. MAJOR STATISTICAL OBSERVATIONS

1. The Role of the FORUM Reporter

Since the beginning of this project, we have envisioned a software "monitor" which would automatically gather statistics on the interaction within

RANKING BY TOTAL MESSAGES EXCHANGED	TOTAL MESSAGES EXCHANGES	NUMBER OF SESSIONS	RANKING BY SESSIONS	NUMBER OF PUBLIC MESSAGES	RANKING BY PUBLIC MESSAGES	PRIVATE MESSAGES SENT	RANKING BY PRIVATE MESSAGES SENT	PRIVATE MESSAGES RECEIVED	RANKING BY PRIVATE MESSAGES RECEIVED
1	354	71	1	51	4	187	1	116	1
2	284	34	3	119	1	95	2	70	2
3	171	46	2	74	2	50	3	47	3
4	101	34	3	58	3	16	8	27	5
5	82	20	6	32	6	24	5	26	6
6	79	15	9	41	5	18	6	20	10
7	62	6	15	9	11	28	4	25	7
8	59	13	10	13	10	18	6	28	4
9	55	18	7	24	7	10	11	21	9
10	49	9	12	14	9	13	10	22	8
11	46	29	4	15	8	17	7	14	11
12	41	13	10	3	17	13	10	25	7
13	33	6	15	4	16	14	9	15	12
14	26	25	5	7	13	3	15	16	11
15	23	11	11	3	17	10	11	10	14
15	23	16	8	8	12	6	13	9	15
15	23	8	13	8	12	9	12	7	17
16	22	2	17	5	15	6	13	11	13
17	15	11	11	6	14	1	17	8	16
18	14	20	6	4	16	4	14	6	18
19	10	25	5	1	19	3	15	6	18
19	10	6	15	1	19	4	14	5	19
20	9	8	13	4	16	2	16	3	21
21	6	1	18	0	20	4	14	2	22
21	6	1	18	1	19	0	18	5	19
21	6	3	16	1	19	1	17	4	20
22	4	6	15	2	18	0	18	2	22
22	4	7	14	1	19	1	17	2	22
23	2	6	15	1	19	0	18	1	23
23	2	6	15	0	20	0	18	2	22
24	0	3	16	0	20	0	18	0	24
24	0	2	17	0	20	0	18	0	24

RANKING BY TOTAL MESSAGES EXCHANGED	PRIVATE MESSAGES EXCHANGED	RANKING BY PRIVATE MESSAGES EXCHANGED	NUMBER OF WORDS IN PRIVATE MESSAGES SENT	NUMBER OF WORDS PER PRIVATE MESSAGE SENT	NUMBER OF WORDS IN PUBLIC MESSAGES	NUMBER OF WORDS PER PUBLIC MESSAGE
1	303	1	6,610	35	3,904	76
2	165	2	1,720	18	5,425	44
3	97	3	2,129	42	5,960	80
4	43	7	871	54	5,782	100
5	50	5	1,282	53	2,472	77
6	38	8	620	34	3,683	90
7	53	4	318	11	285	31
8	46	6	538	29	1,403	108
9	31	10	390	39	1,913	80
10	35	9	318	24	384	27
11	31	10	635	37	1,292	86
12	38	8	656	50	672	224
13	29	11	505	36	130	32
14	19	13	127	42	1,069	152
15	20	12	190	19	171	57
15	15	16	204	34	613	76
15	16	15	389	43	372	46
16	17	14	326	54	158	31
17	9	18	317	317	826	121
18	10	17	450	112	650	162
19	9	18	199	67	65	65
19	9	18	190	48	81	81
20	5	20	111	55	388	97
21	6	19	416	104	0	--
21	5	20	0	--	171	171
21	5	20	160	160	447	447
22	2	22	0	--	217	108
22	3	21	7	7	204	204
23	1	23	0	--	457	457
23	2	22	0	--	0	--
24	0	24	0	--	0	--
24	0	24	0	--	0	--

Table 2. Statistics Derived from FORUM Reporter for the Travel/Communication Tradeoffs Conference (C6)

a FORUM conference without threatening its privacy. Beginning with FORUM-5, a prototype version of this Reporter has been in operation. It has been used in the analysis of all field-test conferences except C1 and the early parts of C2 and C3. The information gathered by the Reporter is similar to that in sociogram analysis, though coders are not needed to observe the interaction. It is possible to gather data about participation rates, message statistics, and a limited number of interpersonal patterns. Since the activity of a computer conference takes place through a machine with statistics-gathering abilities, *the potential to unobtrusively assess elements of the conference (while preserving its privacy) is far beyond that of most other media.*

It is useful to describe briefly how the Reporter statistics can be used in a specific instance. Later we shall review the major findings from all conferences.

Figure 10 shows the overall growth curve for the C6 conference in terms of both public and private messages.* One interesting finding here is that *there were actually more private messages sent than public messages*, though the growth curves are not dramatically different. We have no idea of the content of private messages not addressed to us, but we might surmise that these were used for personal concerns and for less formal interchange. It is likely, as well, that there may have been more humor in the private messages.

A review of the number of entries per day over the 22 days of the conference (see Figure 11) clearly reveals the specific days when computer failures occurred. On two occasions (February 2 and 7), the ARPA network was down for long periods, and these failures came at a point when the conference was becoming quite active. It can be seen that this unfortunate timing of computer failures reached a climax on the last day of the conference when participation approached its highest point and the network failed completely--demanding that the teleconference be ended abruptly.

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*Public messages are those entered for all participants to see, while private messages are seen only by the person(s) to whom they are addressed. For a complete description of interaction modes in FORUM, see Volume 1, Appendix 1.

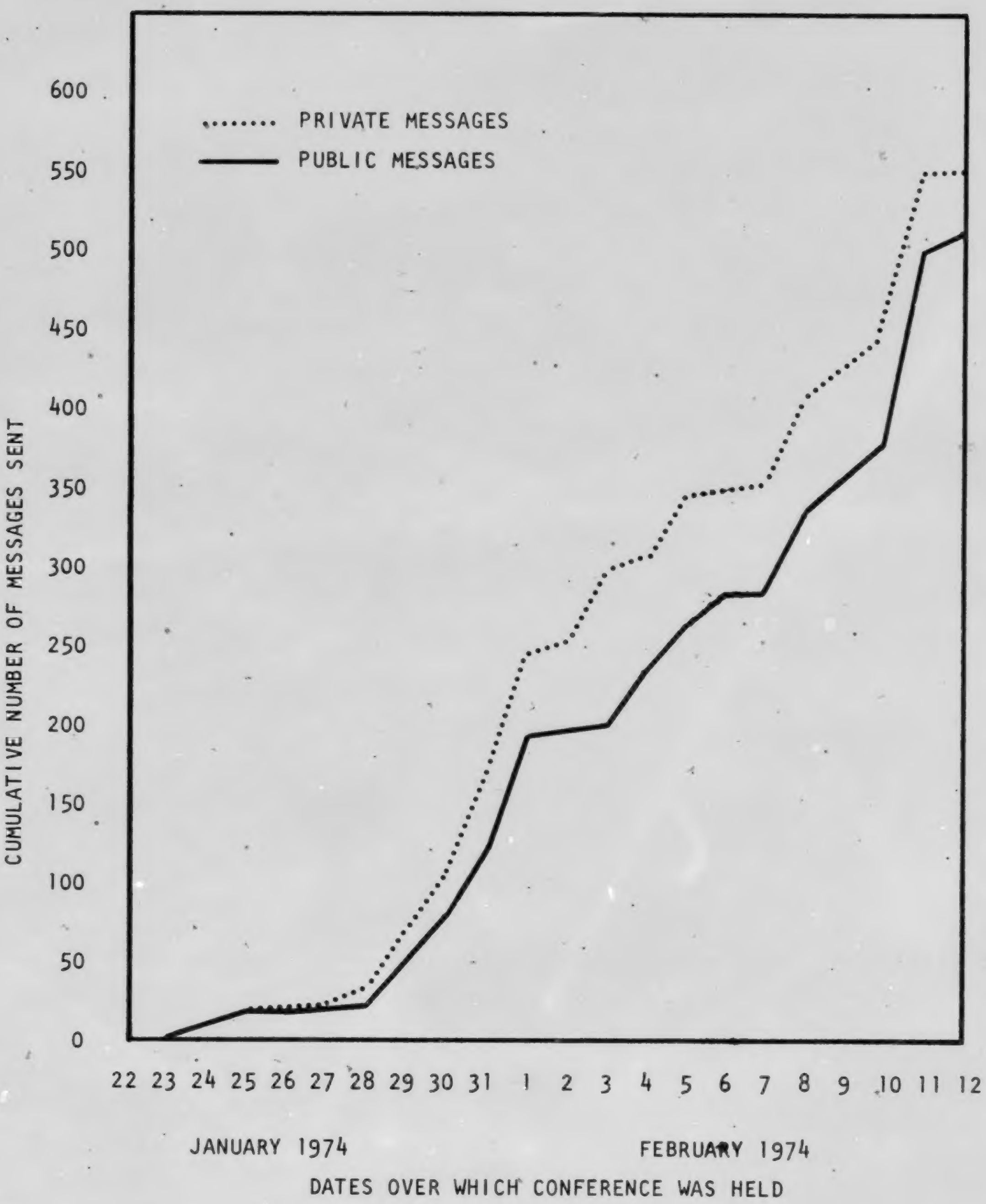

Figure 10. Public and Private Messages for the Travel/ Communication Tradeoffs Conference (C6)

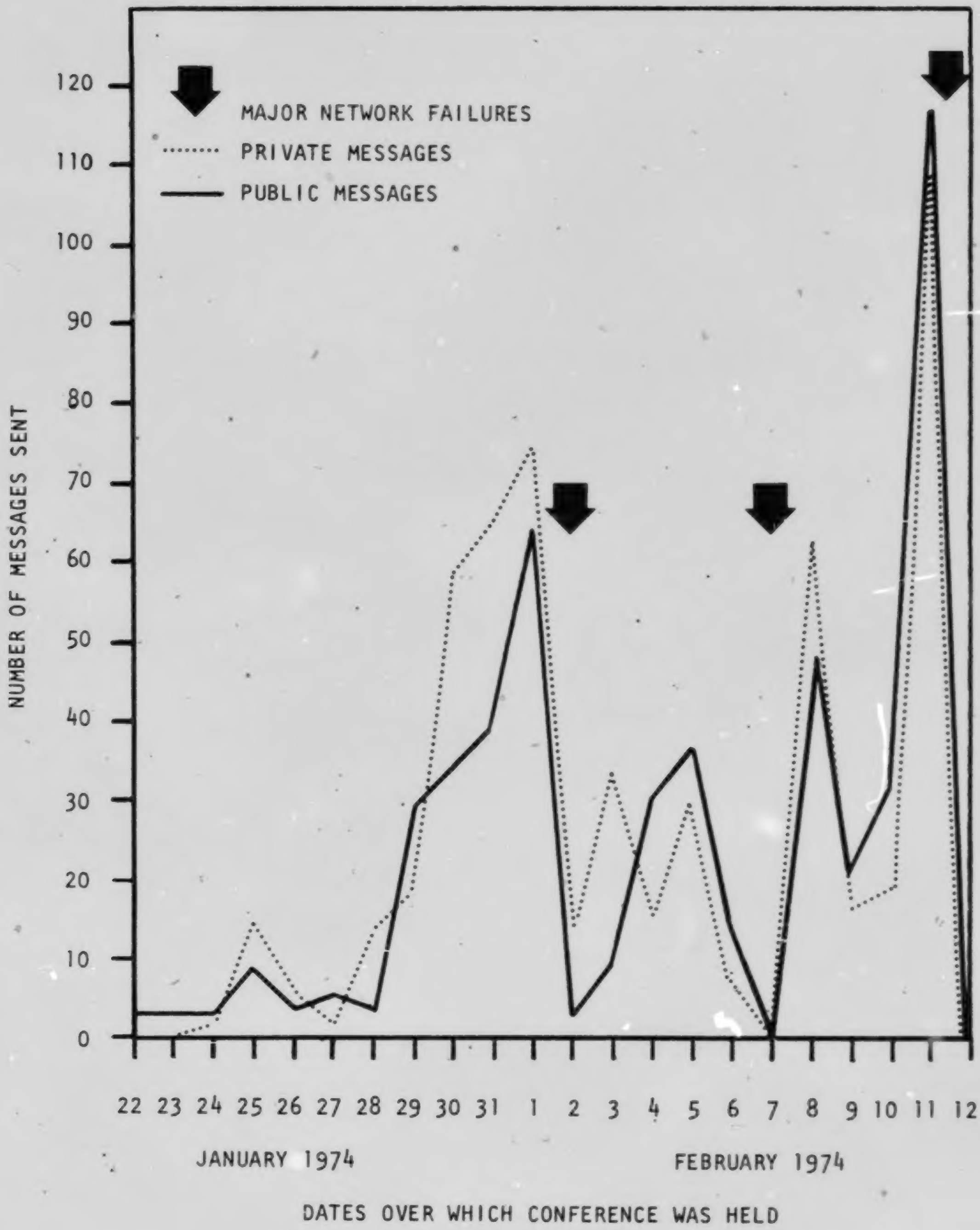

Figure 11. Participation Rate Per Day
(Travel/Communication Tradeoffs Conference)

The participation rates for each person show that the roles of two of the most active participants are those of group facilitator (Johansen) and chairman (Kolleh). The facilitator spent a great deal of time assisting people in using the system, as well as participating in a substantive role. The chairman was also very concerned about the process of the meeting, while still maintaining his key role in substantive proceedings. Thus, the two participants with the most messages exchanged were heavily involved in the pedagogy of the conference.

The distribution of participation in the Travel/Communication Tradeoffs Conference is reminiscent of the small group participation theory of Stephan and Mishler.* In our First Annual Report to the National Science Foundation (August 1973), we have already indicated that preliminary statistics showed participation rates in early FORUM conferences to be similar to those predicted for small face-to-face groups by Stephan and Mishler. This observation is again verified by an analysis of the 12 most active participants in the Tradeoffs Conference (Figure 12).** The similarity is based on the assertion by Stephan and Mishler that, in small groups, there will be a constant ratio of speaking frequencies for adjacently ranked pairs of participants. One interpretation of this similarity of participation between face-to-face and computer conferencing is that this type of teleconferencing does not significantly disturb small group participation. While our work has not sought to replicate the work of Stephan and Mishler, the existence of this parallel is curious, since FORUM is a medium through which everybody can "talk" at once. It is even more surprising to observe the same phenomenon for private messages.***

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*Stephan and Mishler, "The Distribution of Participation in Small Groups: An Exponential Approximation", *American Sociological Review,* Vol. 17 (1952), pp. 598-608.

**Only 12 participants were used as a basis for the calculation, since their input made up almost all of the interaction. Any attempts to actually replicate the original work should obviously provide much more consistency in group size than these tests have provided.

***It has been suggested to us that this observation might simply be an instance of a more general property of group activity, such as the "principle of least effort" described by G. K. Zipf in *Human Behavior,* Cambridge: Addison-Wesley (1949).

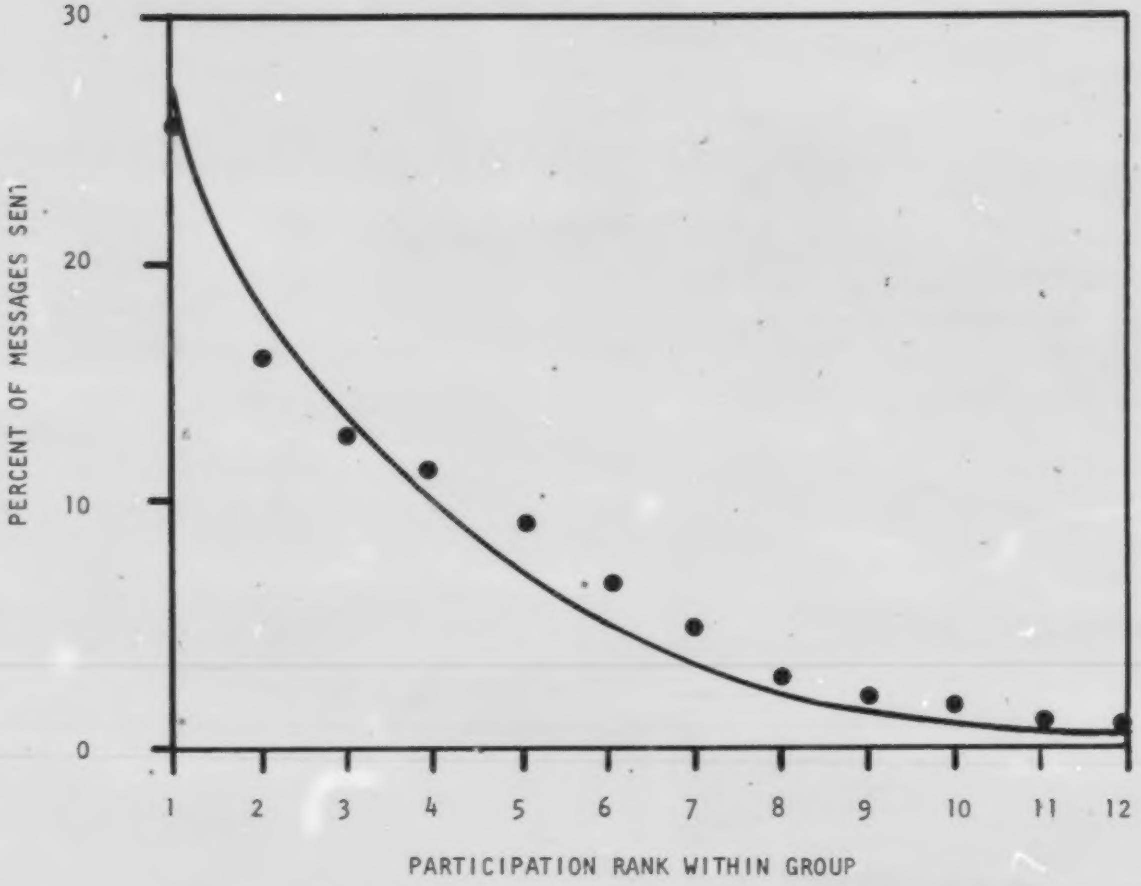

Figure 12. Distribution of Participation in the Travel/Communication Tradeoffs Conference (C6)

Note: The curve was calculated according to the formula developed by Stephan and Mishler for small groups; points on the graph show actual participant ranks in Conference C6 for the 12 most active participants. It should be noted that, in our analysis of each conference held so far, the Stephan and Mishler curve did not always appear; it was, however, very close when a composite curve for all conferences was drawn. Thus, participation rates seem to vary across conferences, sometimes resembling the Stephan and Mishler curve, but sometimes being quite different.

The question of participation rates does, however, raise the issue of basic units of participation. For Stephan and Mishler, it was an "utterance". Unfortunately, this unit is not directly equivalent to an utterance in a computer conference. The analysis described above has been performed using FORUM entries as the basic units of analysis. Thus there is some question as to the degree to which valid comparisons between FORUM conferences and the Stephan and Mishler formula can be made.

2. Participation Maps

In searching for a graphic way to capture and display the major parameters of interaction in a computer conference, we have introduced the concept of a "participation map". This map is a diagram in which one axis (abscissa) represents the number of private messages sent by a specific participant while the other axis represents his number of public entries.

On such a diagram, a participant is represented by a point, but in view of the exponential distribution of participation rates (Figure 12), the "map" becomes clear only when logarithmic scales are used on both axes. We can next represent each participant as a rectangle, with the horizontal dimension proportional to the average length of his private messages and the vertical dimension proportional to the average length of his public messages. On the same diagram, we draw the line with slope 1. Participants to the right and below this line tend to be "private" communicators. Those to the left and above are "public" communicators.

We complete the participation map by drawing a representative sample of the heaviest exchanges of private messages.

The overall result of participation mapping is a graphic presentation of the major conference statistics *as they can be obtained from the computer alone.* Figure 13 shows the participation map for the "Tradeoffs" Conference (C6).

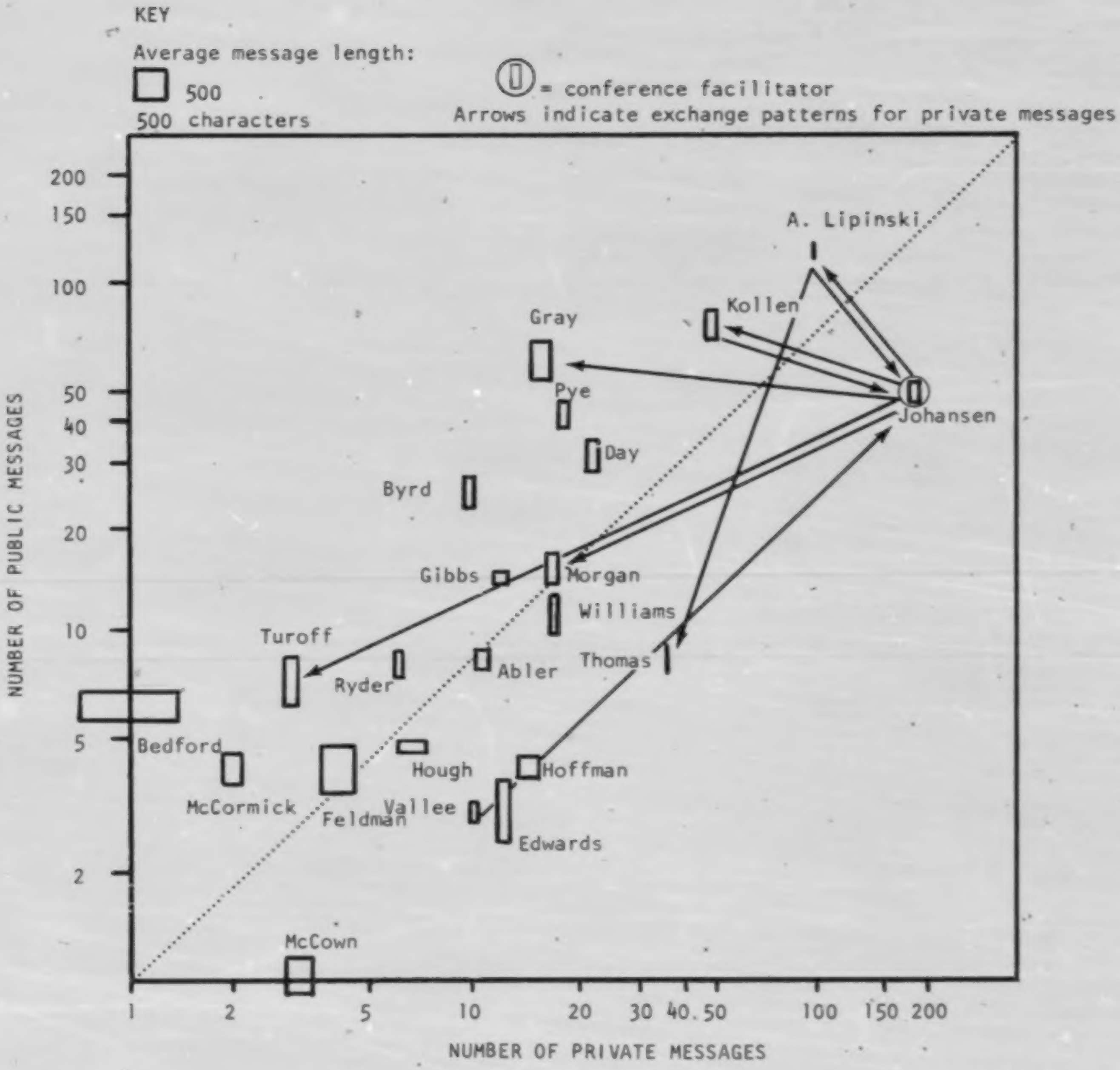

Figure 13. Participation Map for the Travel/Communication Tradeoffs Conference (C6)

3. General Results

Appendix 1 includes the growth curves for conferences C2 through C10 except for C6 which has already been shown in Figure 10. (Growth curves for the public messages have been given in Volume 1 for the staff meeting and experimental design (Figure 10, page 41) and the users' conferences (Figure 12, page 53)). Participation maps for the most relevant conferences are given in Figures 34-38 of Appendix 1.

Figure 14 shows the normalized growth curves of public entries for *all* conferences under study. In order to better compare the patterns of growth for the individual conferences, each conference has been divided into tenths. Each unit on the horizontal axis represents one tenth of the total time elapsed for any conference. Standard scores have been calculated for the cumulative growth of total messages sent (public + private) in each conference.

When the cumulative growth in standard scores is plotted over tenths of conference, three basic patterns of growth can be seen. Figure 14A shows a group of conferences with a fairly constant growth in messages sent. Figure 14B shows a group of conferences which have a negatively accelerated growth: the number of messages sent early in these conferences is greater than that near the end. Participants seem to lose interest in the conference or to expend all the information they are going to transmit early in the conference. Figure 14C shows a group of conferences which display a somewhat positively accelerated growth: most of the entries are sent near the end of the conference in what appears to be a sudden burst of message-sending.

In general, it seems that overall usage of FORUM, in terms of message sending, does not drop off at the end of the conference period. Six out of nine conferences studied here show either a constantly or positively accelerated growth. In the future, it might be useful to examine the social characteristics of these conferences which would differentiate between conferences with different growth patterns.

Figure 15 shows the Spearman correlation coefficients for the correlation between public plus private message-sending. Spearman's RHO was calculated for the number of public entries vs. the number of private entries

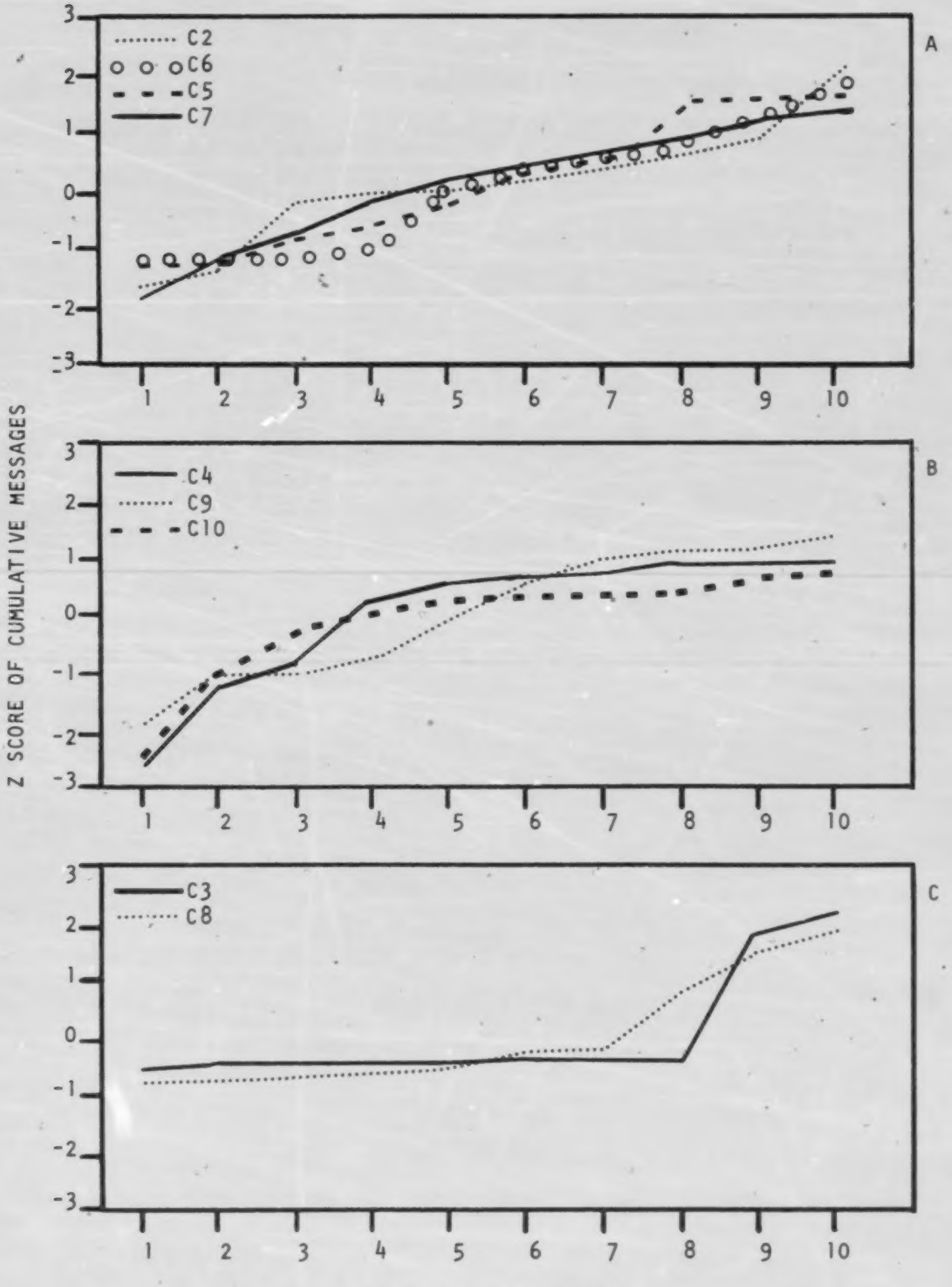

Figure 14. Normalized Growth Curves of Public Entries for All Conferences

Conference	N	r_s	Level of Significance
C2	8	.91	.001
C3	7	.77	.008
C4	7	.61	.07
C6	29	.84	.001
C7	31	.41	.011
C8	21	.29	.103
C10	14	.19	.259

Figure 15. Spearman Rank Correlation Coefficients for Private and Public Message-Sending. (Correlations are generally high, although sample sizes make generalization difficult.)

across the participants in each conference. In general, there is a positive correlation between public and private message-sending. Participants who make more public entries, in general, make more private entries, as revealed by the four significant correlations found and by the fact that all coefficients are positive.

Figure 16 shows the distribution of message lengths and the average length for public entries and private entries. Based on nearly 4,000 messages, the average lengths were 300 characters for public and 200 characters for private messages. Figure 17 shows the length variation of public entries at various phases of the computer conference. Initial entries tend (on the average) to be longer, perhaps because they often involve prepared position statements and self-presentation. Entry length appears to stabilize around 300 characters in the last third of a conference.*

These initial statistical findings certainly suggest directions for future investigation. A summary of these future directions appears in the final chapter of this report.

C. REACTIONS OF FORUM USERS

The reactions of FORUM users to the computer conferencing medium have been gathered in several ways, two of the major techniques being interviews and questionnaires. In addition, one of the field tests involved the use of a log book for comparison of media use.

1. Interviews

Interviews have been used quite extensively to date since they provide a great deal of flexibility in the gathering of responses. The first series of interviews was used with a group at the Information Sciences Institute and have been reported in Volume 1. The format was structured around several areas of focus, with a series of general questions which the interviewer could use as probes. These initial interviews were conducted face to face, though later interviews were conducted via telephone. Each

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*Note that FORUM itself places no limit on the length of a user's statement.

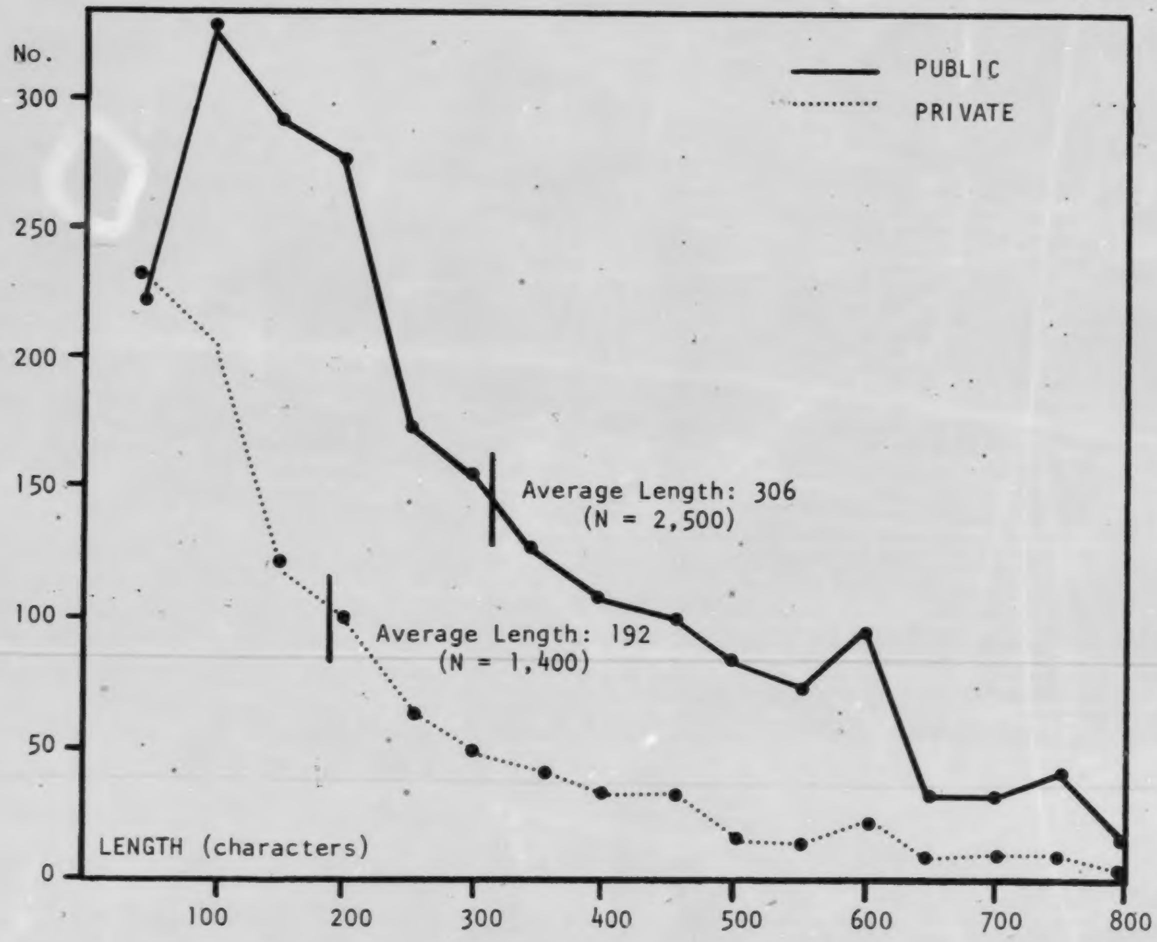

Figure 16. Distribution of Message Lengths In Conferences C2-C10

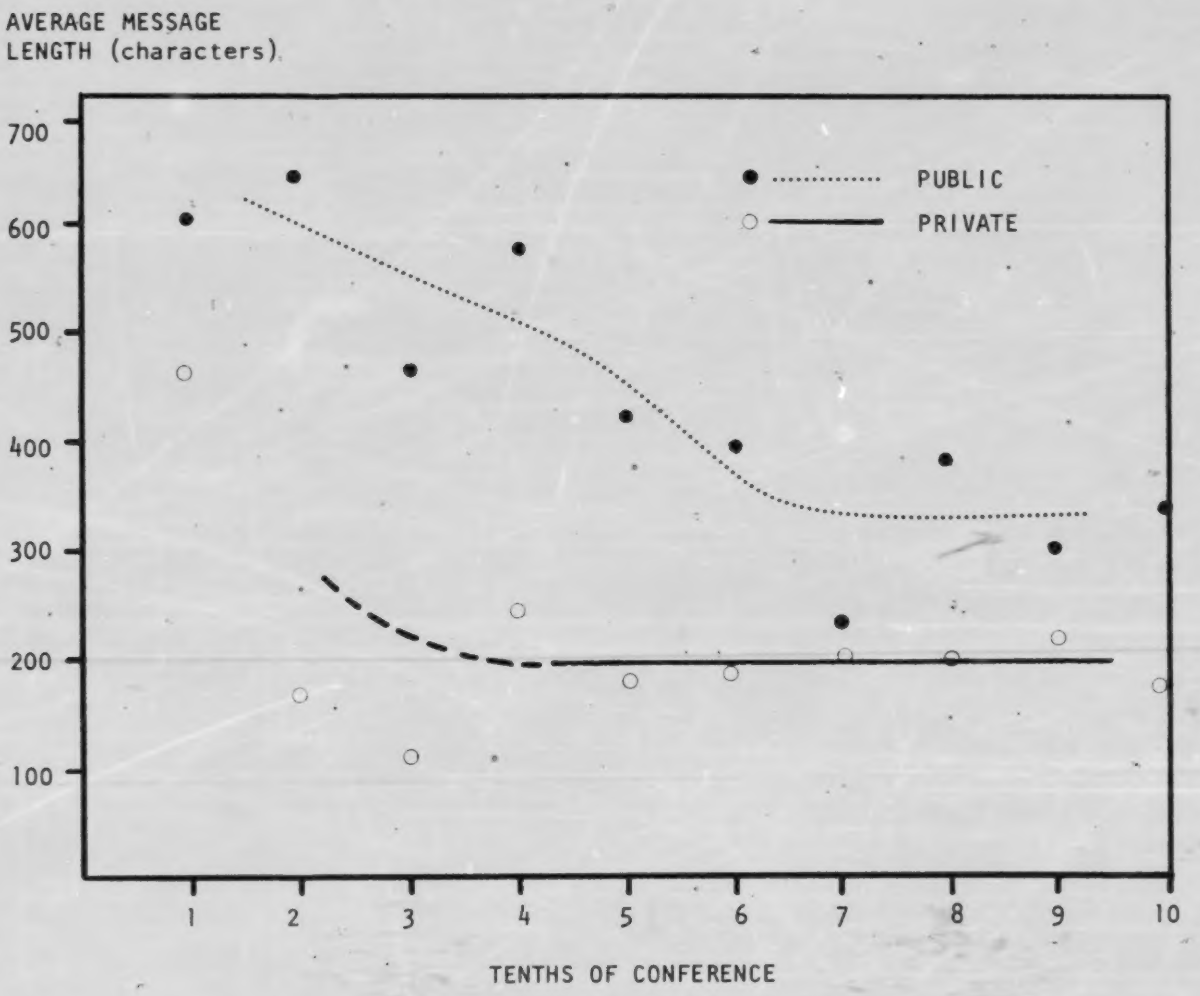

Figure 17. Mean Public and Private Message Length over Tenths of Conference (C2-C10)

interview lasted about twenty minutes and was relatively nondirective. This latter point is important since, in some cases, we were not sure of the important questions. Thus, we felt that more focused techniques, such as questionnaires with precise scales, would have been inappropriate.

The interview schedule was designed to distinguish between strategy of FORUM usage and the particular techniques which were used within the conferences. The major concentrations of the strategic inquiry were the group characteristics, such as the history of the group, the role relationships, and the purposes for the teleconference. Our interest at the tactical level was the actual techniques of usage, as well as the use of other media for parallel communication within a user group.

This style of interviewing was refined for application to later conferences but kept the same general focus. One addition, begun in the Washington State Planning Office test (C5), was the inclusion of interviews *before* use of FORUM began as well as after. In this way, we began to explore *expectations* and a more detailed notion of the type of group interaction before communication through FORUM began. In the case of C5, communication had been ongoing for several months. Again, however, the interviews were not used for gathering precise information according to rigid formats. The goal was to begin a general process in order to identify areas where scales might be appropriate.

2. Questionnaires

Questionnaires were used cautiously during these early sessions since the specific criteria for evaluation were not yet identified. However, as specific criteria were recognized, questionnaires were developed and used in the analysis of two conferences (C5 and C6).

After the Washington Planning Office Conference (C5), a semantic differential scale was used as one measure of the feelings of users toward FORUM as a medium of communication (see Appendix 2). The scales were adapted from the original semantic differentials of Osgood, Suci, and Tannenbaum* by Brian Champness of the Communications Studies Group in

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*C. E. Osgood, G. H. Suci, and P. H. Tannenbaum, *The Measurement of Meaning*, Urbana: University of Illinois Press (1957).

London.* To these scales we added five more which were developed at Bell Laboratories in Murray Hill, New Jersey. Existing scales were used to the maximum degree since one principle of our studies is to compare our work with other research wherever possible. Thus, it might become realistic to compare attitudes toward FORUM with attitudes toward other media, such as audio conferencing or video conferencing. This was only a preliminary attempt to use the semantic differential, however, so the results are not yet complete enough to begin a real data exchange process.

Another questionnaire with the purpose of a systematic collection of overall responses was designed for use with the participants in the Travel/Communication Tradeoffs Conference (C6). Since there were about 42 persons who had accepted the initial invitation to participate in this conference, interviews were difficult to perform. A questionnaire was designed jointly with researchers at Bell Canada and Stanford Research Institute. Because of time and distance constraints, it was not given the kind of detailed pretesting that would have been most desirable. However, the final version was useful in gathering overall reactions to the conference in a systematic fashion.

The questionnaire was mailed with a printed copy of the complete transcript of the conference. The response rate was very high, with 22 persons returning the questionnaire. (Excluding FORUM staff members from the total count of invitees, there were 37 in all, meaning the response rate was about 63 percent, with three additional questionnaires arriving too late to be coded.) Of those who did *not* return questionnaires, only two had made at least five entries in the entire conference, so the response rate for active participants was actually higher than it would seem initially. (Figure 18 shows the distribution of participants as a function of their level of activity.)

The conference participants were first asked to indicate which of the other conferees they had known previously. Responses to this question indicate that the conference renewed contacts among a substantial number of researchers, but that there was also a great number of new meetings (see

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*Brian G. Champness, *Attitudes Towards Person-Person Communications Media,* London: Communications Studies Group, E/72011/CH (1972).

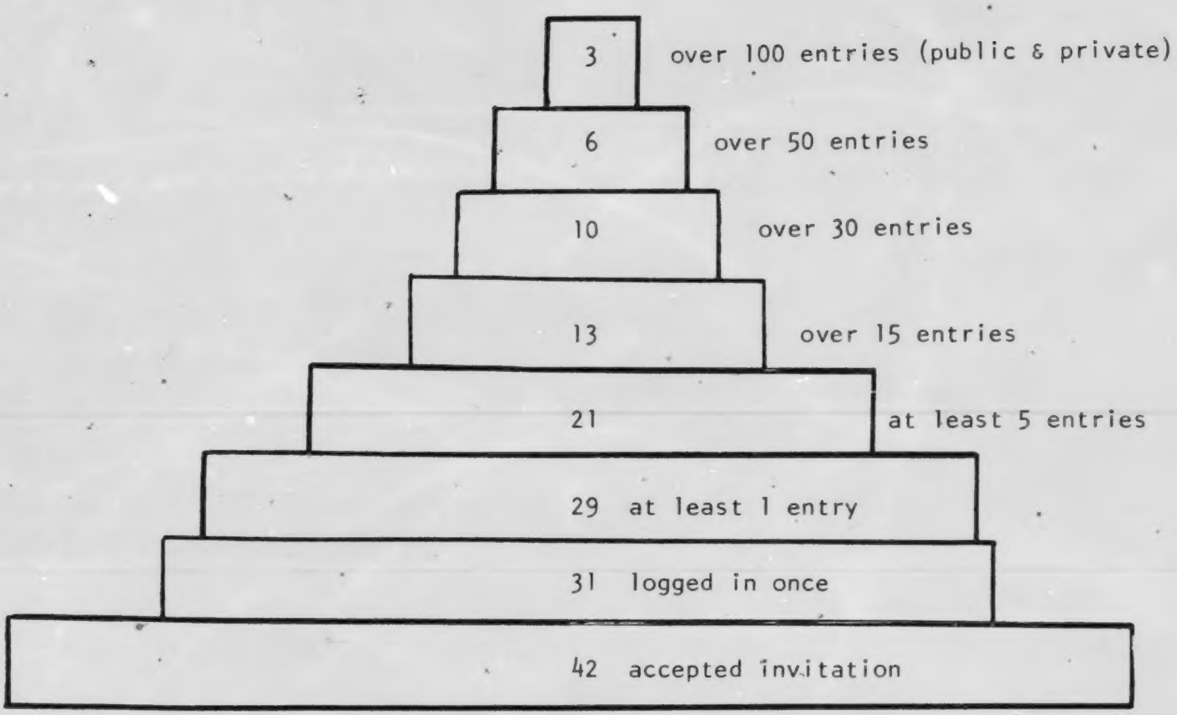
3 over 100 entries (public & private)
6 over 50 entries
10 over 30 entries
13 over 15 entries
21 at least 5 entries
29 at least 1 entry
31 logged in once
42 accepted invitation

Figure 18. Levels of Participation in the Travel/Communication Tradeoffs Conference (C6)

Figure 19). Furthermore, all the respondents indicated that it was likely that they would be following up on new contacts made during the conference. Some follow-ups were already noted; these varied from requests for reprints of articles to invitations to participate in future professional meetings. As was mentioned by Paul Gray in the conference proceedings, "With perhaps three or four exceptions, everyone who is actively working in this field had access to the meeting. This is indeed a remarkable thing; I doubt that the early workers in any field have ever had this opportunity before, unless they were working at the same place."

The overall evaluation of the conference is summarized by responses to two questions. *First, conferees were asked whether they felt their ideas had been presented with some degree of adequacy, even with the various network problems (Figure 20). The second question probed the degree to which each conferee's important reasons for participating in the conference had been satisfied.* The responses to this question (see Figure 21) were again generally positive, with half of the respondents indicating that they were satisfied.

Thus, there is evidence that this conference served to connect an "invisible college" of researchers who had not been completely connected before, and that the overall reaction to the conference was positive. However, the evidence of significant numbers of previous contacts does raise the question of whether the conference was primarily the renewal of an "in-group" of the research community.

The questionnaire results offer only indirect insight at this point. If the conference were simply a renewal of an old in-group, one might expect satisfaction with the conference to show some relationship to the number of people who were known previously. Figure 22 shows, however, that there is no clear association between satisfaction and number of previous contacts. It is interesting that even persons who knew only a few participants before the conference were sometimes very pleased with the results, while those who did have previous contacts were sometimes disappointed.

The questionnaires also documented some of the frustrations which were experienced in the conference, particularly in regard to computer failures on the ARPA network where FORUM was mounted. These failures nearly canceled

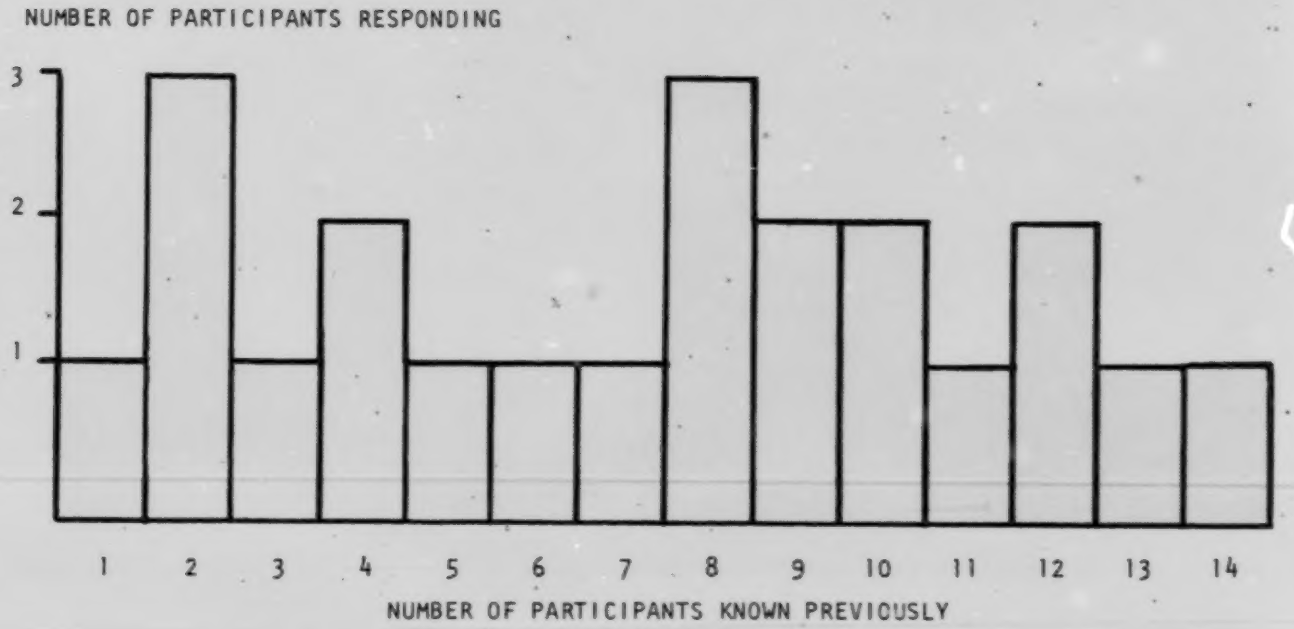

Figure 19. Pre-Teleconference Contact among Participants (C6)

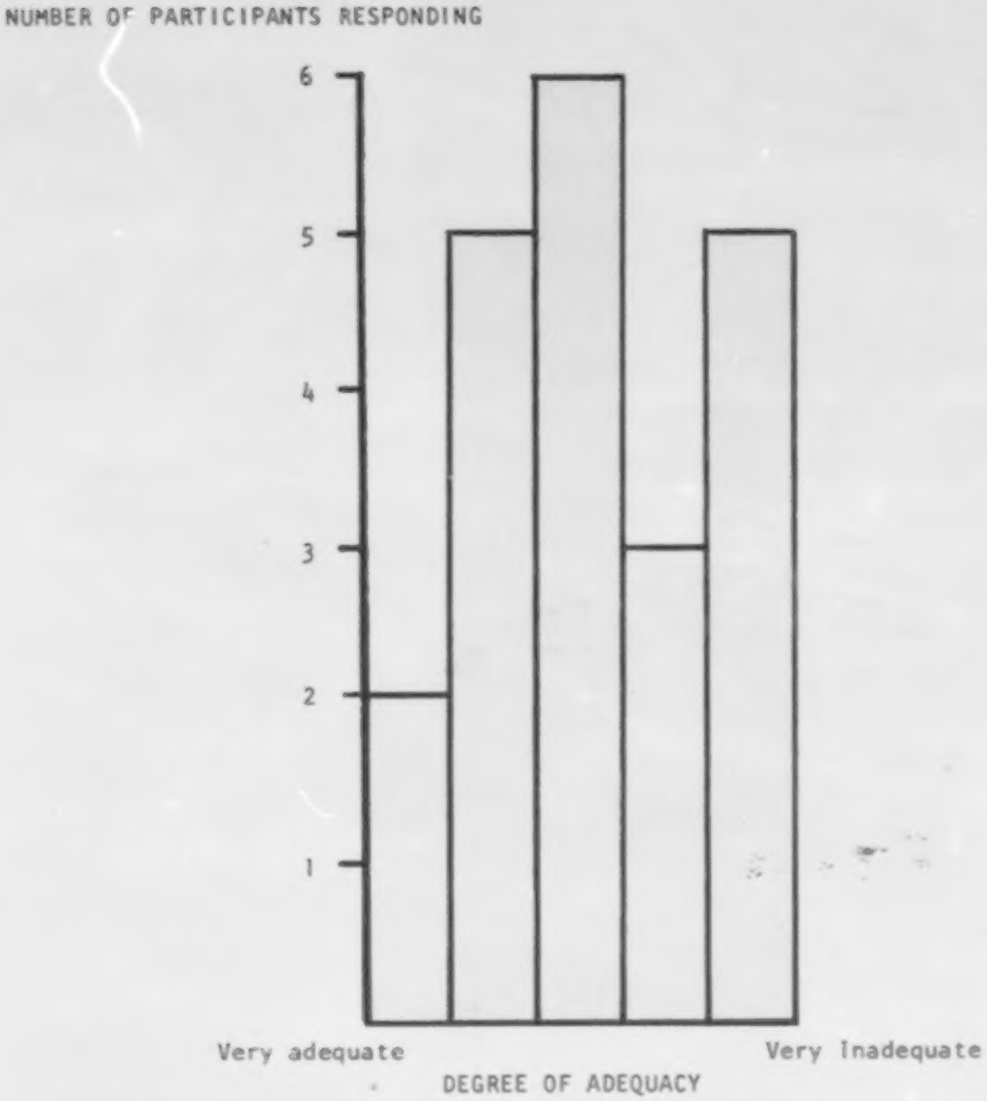

Figure 20. Responses to Question: "Do You Feel You Made an Adequate Presentation of Your Own Ideas?"

the beneficial effects of the conference. All of the participants experienced them to some degree.

The frustration with network reliability was complicated by the problems which participants experienced in getting access to computer terminals at their own research sites. Together, these problems multiplied uncomfortable feelings about the medium, since many had never used a terminal device before. Frequently, participants had to go to other places to get access to a terminal. Some of these problems are expressed in questionnaire comments:

> "Very strong hindrance as I had to use terminal on someone's desk and walk about 300 yards to get there, going outside in rain to do so. Poor access was my most severe problem."

> "The only time I had available was after working hours during which time the building with the terminal was closed."

> "A terminal at home might have increased my participation. If I had had to travel to a terminal, I would probably have made the same sort of contribution as those who came on once and never again. Having it in my office allowed me to participate every day (if we could get on the system)."

> "I could leave the machine on while doing other things without disturbing myself or others. I would then check at intervals if anything had been said."

The last two comments reveal that having easy access to a terminal (e.g., at home or in the office) made a great difference in the degree of participation. All of those who were heavy participants had easy access to a modern computer terminal, and several even left the terminal logged into the conference for extended times (several hours) to meet people as they "dropped in". The terminal itself is obviously an important variable in the overall success of a computer conference. The inconsistency of different terminal devices and the inaccessibility of them to many people are major obstacles to the successful operation of this kind of teleconference.

Other questionnaire comments noted the problems of structuring a computer conference around a broad subject area such as the assessment of telecommunications technology as a travel substitute. There was no initial focus beyond this subject definition, and the substantive dialogue was frequently interrupted by questions about computer conferencing. Although an

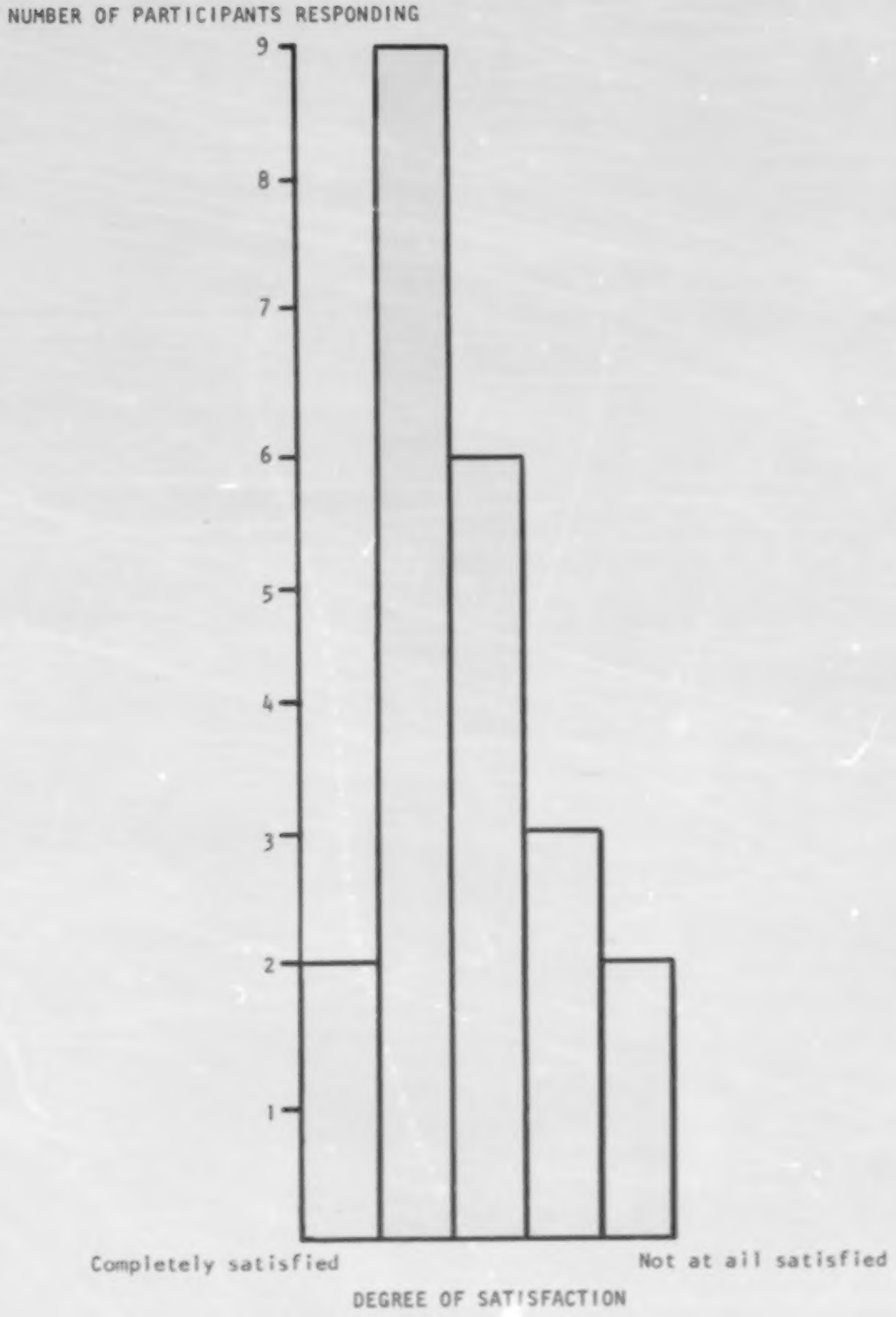

Figure 21. Perceived Satisfaction with Conference C6

DEGREE OF SATISFACTION

NUMBER OF PARTICIPANTS KNOWN PREVIOUSLY	Completely Satisfied				Not at all Satisfied
2	0	0	1	0	0
3	0	1	1	1	0
4	0	2	0	0	0
5	0	0	0	1	0
6	1	0	0	1	0
7	0	1	0	0	0
8	0	0	1	0	0
9	1	1	0	0	1
10	0	0	1	0	0
11	0	1	0	0	1
13	0	1	0	0	0
15	0	1	1	0	0
24	0	1	0	0	0
26	0	0	1	0	0

Figure 22. Crosstabulation of General Satisfaction With Number of Participants Previously Known (See interpretation on page 60.)

agenda was agreed upon and followed with some degree of allegiance, the frequent threads back to earlier subjects (a general characteristic of computer conferences) were disconcerting to some of the participants. Suggestions were made during the conference and on the questionnaire that specific follow-up conferences might be held with smaller groups and more focused topics. Based on the experience of this conference, such suggestions seem worthy of serious consideration.

Since computer conferencing involves communication only through typewriter keyboards, an interesting area of inquiry is the process of "meeting" people in this fashion. The personal experiences in this regard varied greatly but may offer some insight into human implications. The following reactions illustrate the diversity of responses:

> "I found FORUM a very different medium from FTF [face-to-face] conferencing. Because response time was long and medium 'cool', it offers opportunity for all participants to think about what was just said before they respond. In FTF it is often the case that one must respond immediately to what is said for fear of seeming rude or inattentive. Because of this you tend to hear some rather meaningless comments in FTF that the speaker would probably not make if he had to type them out."

> "My comments were generally fairly formal, although, toward the end, some did encourage some less formal contact which helped social contact between us but probably distracted others. The private message function was used for chatty little comments more frequently--the inclusion of these in any analysis would give a different picture of the formality of the process."

> "Relationships were established easily, personalities came across, conversations could and can be established this way, and that's partly why I'm now a believer."

> "I was surprised to find that 'effective' relationships can be developed over the system. The time zone problem was somewhat inhibitive of ease of access; this also was true because of terminal/network problems--especially in the UK."

> "I feel such kind of dialog with people *you haven't met* is usually too sterile and tends toward unnecessary formality."

> "This offered people who would never meet the chance to interact on a semipersonal basis. Time differences: i.e., persons in the evening in the UK interacting with others in bed with a portable terminal in California early a.m. Computer conferencing also helps get around time differences in the asynchronous mode."

> "Can't communicate as freely over teletype as in person."
>
> "I found it difficult to organize my thoughts and type grammatically. When committing thoughts to paper there is usually a much greater opportunity to correct and amend the text."
>
> "Actually, expressing my ideas by typing with FORUM was not the problem I suspected it might be. In fact, typing allows one to give more *consideration* and *focus* to what one is saying."

Though we have not yet begun to make extensive use of questionnaires, we are optimistic about the use of standard groups of questions to compare research results involving different media. Since the face-to-face workshop which we organized in Menlo Park to consider questions of social research with teleconferencing systems, we have been pursuing the idea of active exchange of research results. A FORUM conference on this topic, with the Communications Studies Group, Bell Laboratories, and Institute for the Future as the principal participants, has attempted to create a common questionnaire for use by CSG and the Institute. This questionnaire will initially allow direct comparison between FORUM and the Remote Meeting Table, an audio conferencing system developed by CSG. We hope that this exchange will grow into a kind of "pool" of questions from which other researchers can draw. The results will then, at some point, provide a basis for international and intermedia comparison.

3. Log Books

During the Washington Planning Office Conference (C5), the conferees were asked to use a log book to record each time a communication was made using a medium other than FORUM. The log book had small pages laid out in the following format:

What medium used?
Telephone______ Mail______ Travel______ Other______
To whom? (including copies)
Why this medium?
Date and time? (Both time of day and duration of communication)

The conferees were asked to answer this set of questions each time they chose another medium. The purpose of this method was to explore the reasons that other media were used, and conversely, that FORUM was not used for certain types of communication. When used together with other measures (e.g., records of phone calls made, letters exchanged, etc.), the log provides a more open-ended method for registering feelings about choices among available media. Attempts can then be made to derive characteristic reasons for using (or not using) a particular medium of communication.

The major disadvantage of the log book is its obtrusiveness. It takes a real degree of commitment on the part of conferees to record each choice of medium, and undoubtedly, some of these will go unrecorded. (Some check on the frequency of use can be done by comparison with actual usage statistics for other media, however.) Thus, the log book provides useful information only if the conferees can be assumed to have a rather high degree of commitment to it.

4. Subjective Analysis of Task Performance

In Conference C9, the Project AWARE discussion, a special study of the text has been made; here we observed a high number of daily entries compared to the other conferences studied in this report. The entries themselves fall into the following categories:

- Questions and instructions on how to use FORUM
- Work instructions and assignments
- Exchange of topic-related information
- Planning of activities
- Decision-making
- Editing of texts of letters and brochures
- Personal interactions, greetings, and comments

Most of the entries were much shorter than the entries in any of the other conferences and would often consist of only one word or one line. There were many more personal comments and much less formality. Private messages were used infrequently, since with only three participants, the conference provided an atmosphere of privacy.

In assessing the results of this FORUM conference, we looked at two aspects: first, the tasks the group was able to perform and, second, the personal satisfaction with the medium.

In relation to a forthcoming seminar, the group drew up the agenda, discussed participants and roles, and planned letters, brochures, and materials to be sent. FORUM was also used to decide the location for the seminar. Various options were suggested and investigated, and the staff discussed what was needed, from physical requirements to "tone" to price. They chose a place and then followed through with the actual arrangements.

In terms of project research, strategies were decided, research was reported and discussed, and persons were assigned to or took specific tasks. Along with all these items, the group planned and coordinated its everyday activities.

C9 was thus not simply a discussion conference: operational decisions were made, action taken, and project activities continued. To that extent, the group carried on its regular work using FORUM for communication. This observation should be qualified by noting that there was some communication in addition to FORUM. There was one face-to-face meeting, principally devoted to editing text materials for the seminar. One person occasionally delivered papers at home to the group leader, and there were a few telephone calls (but very few, said one staff member, who commented that using the phone much of the time would have been unsatisfactory because of the necessity of taking notes and the ease of forgetting information).

The second aspect considered in assessing this conference was the reaction of the participants to using FORUM to communicate. Each participant's opinion was obtained through interviews and discussion. From these opinions we may conclude that the use of FORUM in the asynchronous mode was extremely convenient. The group leader, for example, could enter messages at any time practical for him, and these messages would always be waiting for those at the other end. When people are in and out of their offices, any specific phone call may not be able to reach them, while FORUM is always open for sending and receiving. An inspection of the transcript suggests further that it would have been difficult to handle the large number of entries via the telephone, requiring, as many did, consideration, dialogue, or outside checking of information. The use of FORUM also forced the group to organize its work and its communication more carefully. Members found that the medium required them to be precise in their questions, answers, and instructions to each other. In addition, the written record provided an easy way to answer any question of what was said by any person.

However, one person commented that writing does not convey the nuances found in facial expression or vocal inflections, so that feelings, emphasis, and interpretations could get lost in the communication. For this reason, it was sometimes difficult to get a sense of priorities from the written messages.

All agreed that the review feature of FORUM was useful. This feature enabled one researcher, who was in and out of the office during the time period of the conference, to obtain, on his return, all the entries addressed to him, provided they included his name in the text. "Review" also enabled another person interviewed to pull out all the items on a particular company or subject to learn what had been done or discussed on some topic (she estimated that she used this feature ten to twelve times).

The medium was unwieldy for discussing the drafts of letters and texts. When ideas had to be "batted around" and thoughts were not yet specific, or when many alternative formulations were to be considered, the time taken up was considerable; this process was thus inefficient and frustrating.

The work and personality characteristics were clearly related to the feeling of satisfaction which the participants expressed. The group leader, who was constrained to be at home and intermittently up and down (he was recuperating from back surgery), was pleased with how it enabled him to continue his direction of the project. Another researcher, who worked full time on the project and spent the most time in the office with the terminal, liked the medium and its use. The staff member who had divided work responsibilities (so that he was out of the office frequently) and who is attentive to facial expression, gestures, and tone of voice in communication, found it less efficient for his project work.

In summary, project operations could be continued via FORUM in a two-week situation in which neither telephone nor face-to-face communication would have been satisfactory. *The FORUM conference had advantages even beyond the usual project communication, including the written record,* *precision of statement, and enforced organization. On the other hand, it seemed less efficient for drafting and revising textual materials and for communicating messages such as values which normally come through non-verbal communication.*

D. CONTENT ANALYSIS

1. Content Categories

Since the transcript is an inherent part of FORUM communication, the possibilities for content analysis are quite promising. Our first exploration of these possibilities occurred during the first year of our work in this project, with an early version of FORUM. In that situation, we established three basic categories for messages: problem-solving, information exchange, and general discussion. Each message was also classified as either dyadic or group-oriented, in terms of the direction of the statement. In these preliminary investigations, we noted that the early portions of a conference were frequently dominated by "information exchange" comments, usually involving learning about the system. Later in the conference, more "problem-solving" entries occurred, as the substantive purpose became the focus of attention. Though both dyadic and group-oriented comments occurred, no clear pattern was suggested.

These exploratory techniques were used to gain preliminary information about the length of time necessary for various persons to become comfortable with FORUM and to explore different ways of introducing the system to users. The trend toward problem-solving shows the movement from initial quick exchanges (usually about the operation of the system) to more substantive discussions of the problem area preassigned as a topic. The data on group versus dyadic orientation was useful before the private message feature was introduced and as a way of identifying significant subgroups within the conference.

In the analysis of the Travel/Communication Tradeoffs Conference (C6), James H. Kollen at Bell Canada developed a series of content categories that are more specific than those mentioned above. The frequency of each category can be plotted over time to show the evolution of the conference more specifically. Also, the social dynamics of the conference can be summarized and analyzed with some precision (see Table 3). A major problem which arises here, as with participation rates, is the definition of a basic unit of communication. Each FORUM message is determined by a particular conferee and may actually contain several different content categories within it. Thus, the content categories should not necessarily be structured around the discrete FORUM entries.

The problems in performing analysis by content categories mean that the coding process is always long and tedious and that the results are typically not available until long after the conference has concluded. Many of these problems could be alleviated if a method for doing content analysis via computer could be developed.

2. Topic and Interactive Thread Analysis

Another kind of content analysis involves the tracing of specific themes as they evolve over the course of a conference. Though our experience is still limited and the procedures are not standardized, *the method has a unique relevance to communication through computers*. One of the basic patterns of computer conferencing is the tendency for "threads" or "chains" to occur during the conference.* These threads are particular topics which are introduced but not necessarily fully discussed in a consecutive series of comments. In fact, there may be long interludes between comments on a certain topic. Or in the case of a conference in which several people are involved simultaneously, it is often possible to discuss several topics at once, with a series of threads connecting the comments. (The thread may be facilitated directly by saying "re. Comment 13", or it could be tied more implicitly to an earlier idea, as in "re. the summer workshop...".)

Given the existence of these topic threads, it is then possible to trace them over time. Such a process reveals key points in the *life* of a topic thread: the introduction of a new idea, the continuation of the idea,

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*An example of a FORUM discussion with multiple threads has been given in Volume 1, pp. 56-58.

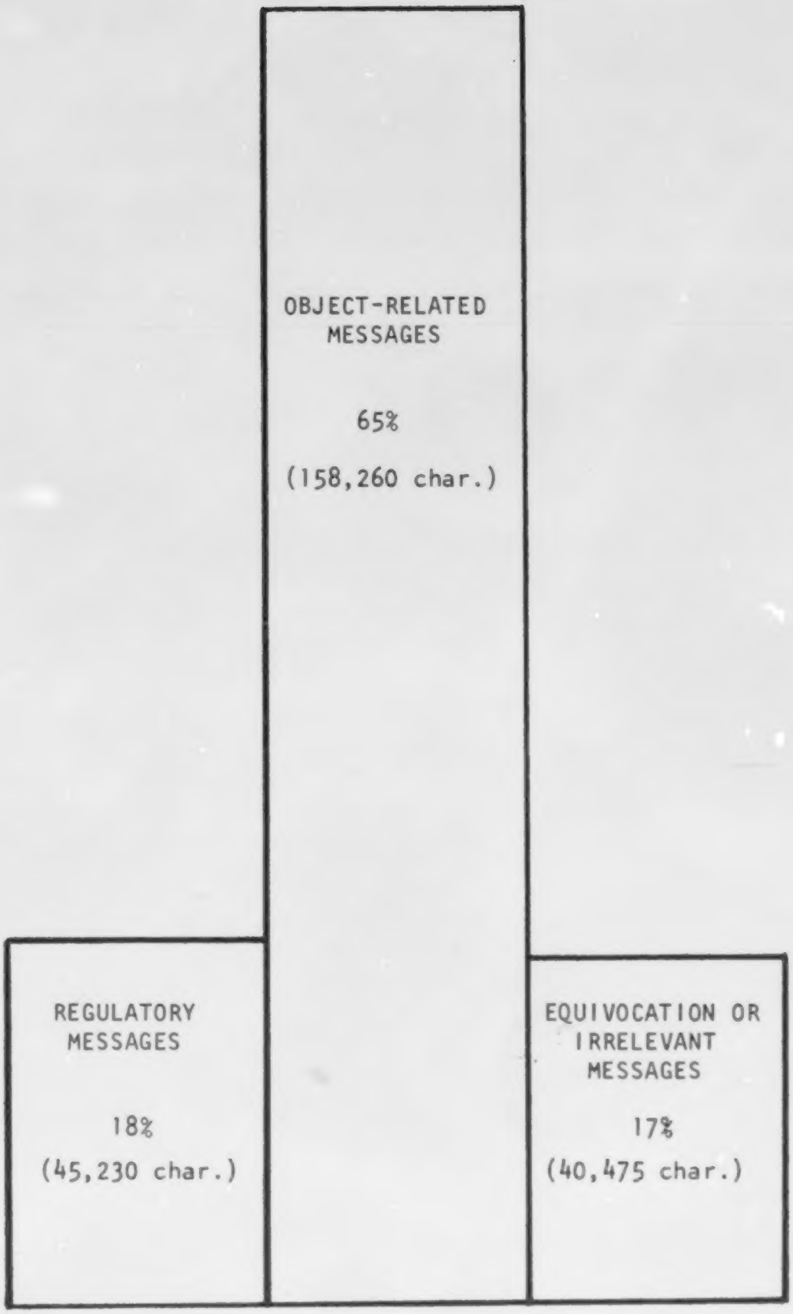

Table 3. Content Categories of All Messages in Conference C6 As Developed by James H. Kollen of the Business Planning Group at Bell Canada.

and the synthesis or climax of the idea. Of course, there are also ideas which are introduced, but from which a topic thread never grows.

When topic threads are then identified with the participant who expressed them, it is possible to see a pattern of roles developing. In some cases, for instance, particular persons tend to introduce many new ideas, while others function as idea-developers, and still others as synthesizers of previously developed ideas. These roles could vary greatly among persons and conferences. Thus, by examining the overall patterns for a FORUM conference, one can see both key persons (roles) and key ideas.

This section describes an initial attempt to perform such an analysis on part of a FORUM transcript. The transcript is from the XYZ conference (C4), which took place during November/December 1973. The basic unit of analysis was the FORUM "entry", a paragraph of input text labeled by FORUM as to its sequence number, author, and date and time of origin. In Conference C4, 388 public entries were coded (equivalent to 47 pages of single-spaced text).

Seven individuals participated in the conference, three of whom were Institute for the Future personnel. As we shall see, there was considerable difference among the patterns of participants' contributions (see Table 4). Even more important is the great disparity in the number of various participants' contributions (see Table 5).

Turning now to the main analytical contribution, we shall examine the logical sequences of substantively interrelated entries in the conference. For brevity, each such sequence will be referred to as a "chain". Each chain is defined as the downstream flow of entries clearly following from one "new-idea" entry, and the latter, in turn, as an entry for which no obvious and direct inspiration by a preceding entry is discernible. Of course, such definitions leave much to the judgment of the coder, but many items contained explicit cross references such as "re. 207". In our estimation, intercoder reliability would be very high, no more than a very few percent of the necessary coding decisions being at all doubtful.

The analysis of C4, then, consisted of a close reading of the conference transcript, identification of the precursors, if any, of the substance of each entry, and recording of the observed linkages in a format similar

Participant	Period			Overall
	I	II	III	
1	288	882	306	324
2*	186	288	--	204
3*	252	300	336	300
4	300	192	210	222
5	--	468	240	378
6	--	144	132	138
7*	--	222	660	330
Overall	252	288	282	276

*IFTF staff member

Table 4. Average Length of Entries by Participant and Period (C4) (in Characters)

Participant	Period			Total
	I	II	III	
1	36	3	25	64
2*	32	6	0	38
3*	32	40	51	123
4	25	46	24	95
5	0	8	5	13
6	0	15	11	26
7*	0	3	1	4

*IFTF staff member

Table 5. Number of Entries by Participant and Period (C4)
(anonymous entries excluded)

to that of Figure 23. (The resulting flow-chart was a six-foot vertical scroll.) The transcript was further analyzed according to a variety of criteria. Any entry which headed a chain was, by definition, a "new idea" entry. An entry at which two pre-existing chains converged (e.g., entry 5 in Figure 23) was deemed a "synthetic" entry. One from which two or more subchains diverged was defined as a "provocative" entry. And finally, any entry at which a chain terminated was judged a "dud", since no one saw fit to respond to it.

As might be expected, the average number of entries in a chain increases with the number of participants who contribute to that chain. It is a less obvious finding that the average number of entries *per participant* is highest for chains to which either relatively few or relatively many participants contribute. A possible explanation for this (borne out by examination of the content of the chains in question) is that chains with few contributors tend to be closely knit mono- or dialogues with few abrupt (chain-terminating) changes of subject, whereas chains with many contributors tend to be unusually important ones on which everyone has not only something but, in fact, a great deal to say.

The following relations may be taken as tentative conclusions of our topic thread analysis and perhaps as candidate hypotheses for subsequent replicative study.

- The number of *new* ideas which a participant contributes correlates significantly with both the number and frequency of *provocative* ideas which he contributes.
- The frequency with which a participant contributes *new* ideas has a significant negative correlation with his frequency of *synthetic* ideas.

Together, *these two propositions suggest that at least two mutually exclusive types of conference participants are discernible* (influenced perhaps by role perceptions). One type strives to advance the conference by introducing substantive material which is either new or of such importance that several others may be inspired to respond. The other type strives to facilitate the conference by gathering up loose strands and bringing the discussion back to its prescribed theme.

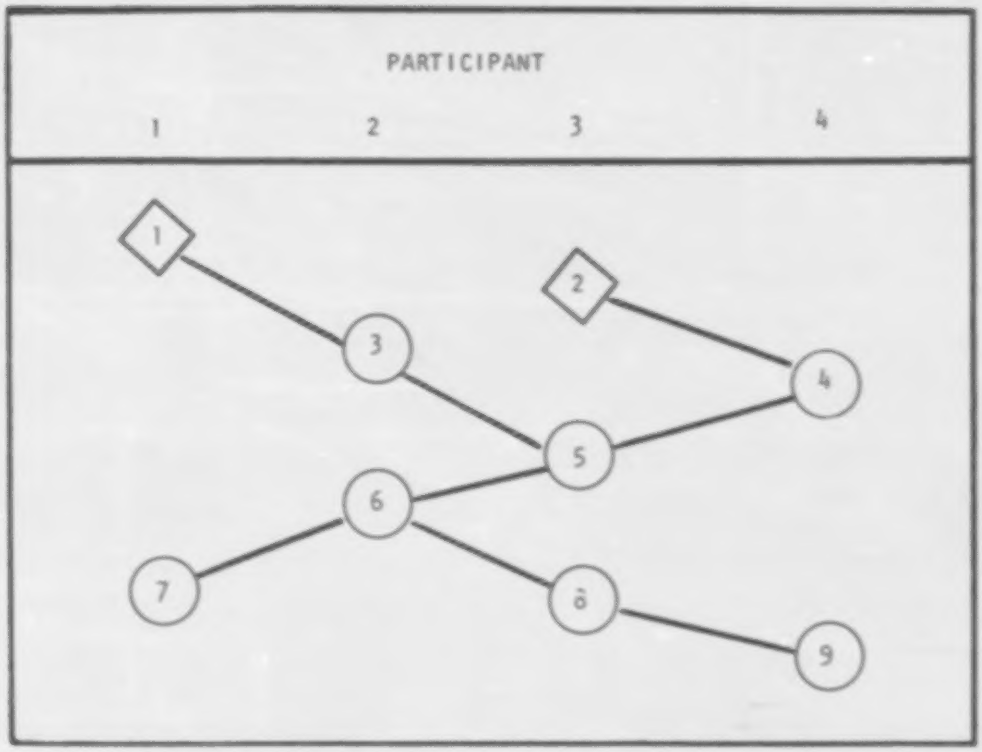
PARTICIPANT
1
2
3
4
1
2
3
4
5
6
7
8
9

Figure 23. Hypothetical Sequence of Entries,
Showing Chains 1-3-5-6-7-8-9 and
2-4-5-6-7-8-9
(◇ = new idea, ○ = regular entry
lines = substantive links)

A second approach to thread analysis of conference transcripts was developed by Gwen Edwards of Stanford Research Institute, parallel with the work of James H. Kollen, mentioned earlier. Rather than concentrating on topic threads over time, Edwards observed interactive patterns. Figure 24 shows the categories which she established, with the basic distinction being between person-directed and group-directed comments. By following the threads of these comments over time, she was able to see the kind of comments that prompted the longest interaction and the type of interaction which occurred. The basis for this analysis is "type of interaction", though it uses the content categories developed by Kollen.

3. Semantic Analysis

One of the most important concerns about FORUM, as already described in Section III-C (Reactions of FORUM Users), is the loss of those nonlinguistic communications which accompany face-to-face meetings. FORUM conferences are entirely in the written mode; there are no paralinguistic vocal cues--such as pitch, intonation, pauses, or stress--nor are there physical presence cues such as facial expression, posture, or movement. In face-to-face communication, some of these cues are very important in regulating the interaction and flow of the discussion. Others are used in communicating messages of emotional feelings and attitudes toward other participants. In FORUM, some of these messages do get translated into written form--"This terminal is ugly!" or "Let's move on to the next topic." However, there is a distinct narrowing of what is transmitted, and many emotional, interpersonal messages disappear. It may be, of course, that such messages are not always necessary to discussion. But when the only context for "meeting" a person is an impersonal keyboard and an equally impersonal terminal printout, the personalities of the users might seem inaccessible.

With this concern in mind, we have explored an approach which has proven rewarding in analyzing FORUM transcripts to see how much paralinguistic and nonlinguistic communication may be translated into the written mode. Our approach involves a careful study of the use, order, and frequency of words within the context of a conference environment and is based on earlier

	MESSAGES SENT	RESPONSES TO MESSAGES	RESPONSES TO RESPONSES (TOPIC THREADS)	MESSAGES WHICH DID NOT RECEIVE RESPONSE	PERCENT OF ENTRIES WHICH ARE INTERACTIVE
PERSON-DIRECTED MESSAGES	114	54	29	61	69%
UNDIRECTED MESSAGES	287	121	45	188	58%
TOTAL	401	175	74	249	62%

Figure 24. Summary of Interactive Patterns in Conference C6, As Developed by Gwen Edwards of Stanford Research Institute

CONTENT CODING CATEGORY	TOTAL NUMBER OF CHARACTERS SENT	% OF COMMUNICATION WHICH INVOLVED DIRECT INTERACTION WITH OTHERS	NUMBER OF CHARACTERS SENT INTERACTIVELY
REGULATORY (e.g., procedural topics, discussion of possible agendas; attempts to focus discussion)	45,230 (18%)	57%	25,780 (17%)
OBJECT-RELATED (e.g., personal introduction and background; substantive discussion; methodological comments)	158,260 (65%)	68%	107,615 (69%)
EQUIVOCATION OR IRRELEVANT (e.g., affective remarks, indications of computer trouble, etc.)	40,475 (17%)	53%	21,450 (14%)

Table 6. Interaction Patterns in Conference C6, According to Content Categories (Combination of Kollen and Edwards Approaches)

contributions from Pittenger, Hockett, and Daheny* and from Edwin Schneidman.** The former have used microscopic interview analysis to successfully infer, from an analysis of the first five minutes of a tape-recorded psychiatric session, the basic psychiatric problems of the patient. Schneidman has used logical content analysis to infer certain aspects of an individual's cognitive styles from an inspection of written or spoken text. Finally, Laffal's*** method of word association analysis, which often reveals implicit levels of meaning in a transcript, has also provided a basis for our approach.

a. Technique

This approach involves three key assumptions: First, a generalization and basic principle is that everything communicated is meaningful; i.e., all aspects of the transcript are to be considered. Second, meaning and pattern in communication are culturally based and then mediated by the individual person, the communication situation (e.g., the medium, the task), and the others in the situation. Third, communication may be about the topic, but it is also about the communicators themselves, about the situation, and about any immediate concern. Furthermore, a list of the possible subjects to which participants are likely to respond or refer in any communication would include:

- The topic of the discussion, usually overtly
- Ordering or structure messages
- Feelings and emotions regarding the individual himself, the topic, the discussion or the process of communication, and another participant

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*R. E. Pittinger, C. F. Hockett, and J. J. Daheny, *The First Five Minutes: A Sample of Microscopic Interview Analysis*, Ithaca, New York: Paul Martineau (1960). See also Arthur Hastings, "The First Five Minutes: A Review and Discussion," *ETC: A Review of General Semantics* (December 1964).

**Edwin S. Schneidman, *The Logics of Communication: A Manual for Analysis*, China Lake, California: U.S. Naval Ordnance Test Station (1966).

***Julius Laffal, *Pathological and Normal Language*, New York: Atherton Press (1965). Also: "Contextual Similarities as a Basis for Inference," in George Gerbner, et. al., *The Analysis of Communication Content*, New York: John Wiley (1969).

- Personal relationships (e.g., roles) or group relations
- Intentions
- References to a covert topic

These may occur in questions, answers, information, offers, emotional responses, and many other forms. The subjects are not necessarily overt and a part of the surface line of the written text; indeed, the first two are usually the surface content, and the others occur more implicitly in choices of words, sequencing, and other linguistic subsystems. Our analysis has sought to uncover such communications.

In applying this technique to FORUM transcripts, it is important to note the characteristics of the FORUM system. The author of an entry has the option of editing or rewriting his contribution to any extent he desires before it is entered into the transcript; he may alter a misspelling, rewrite the entire entry, prepare it in advance, or even cancel it. Thus, we are not necessarily reading a spontaneous comment. Instead, there may be several layers of revision based on the writer's wish to clarify, add evidence, impress himself, impress others, protect himself, or take into account the reactions of other participants. Editing also occurs in face-to-face communication, but it is internal. We do not know whether there would be more or less editing in writing compared with speaking or whether the individual is consistent in the amount of editing he does regardless of the mode or the context. (Data relevant to editing activity in FORUM-6 will be obtained by having the system keep track of the use of editing functions which could then be correlated with individuals, types of conferences, and the purposes of the discussion.)

Also, because FORUM conferences are usually circumscribed in subject matter, there is pressure on the participants to stick to the topic, whether it be the design of experiments, the use of teleconferencing systems, or the ongoing operations of the group. Depending on the number of participants, their acquaintance with each other, and the public nature of the conference, the amount of personal and non-topic messages will be affected. In an open, many-participant, subject-labeled conference, there will likely be constraints pressing towards formality, logical consistency, and lack of emotionally toned messages.

One other factor will affect the content of the transcripts: the physical requirements of the system itself. A computer terminal is slightly different from a typewriter in arrangement of some keys, in the touch required, and in the time delay of the printing. These factors all require some adjustment on the part of the user, and until he feels comfortable, he is likely to be self conscious and perhaps hesitant in his entries. In the same manner, if typing itself is slow or if there is self-consciousness regarding it, then we would expect entries to be more selective, less frequent, and also shorter, and so not necessarily reflective of the total reactions of the participant.

These qualifications all point to areas in which we must make assumptions about factors which affect the communication process in teleconferencing via FORUM. There is almost no research (hard or soft) on these issues, and for that reason, we have to rely on heuristic assumptions drawn from our present store of experience with FORUM and other media of communication. In summary, these are:

1. Teleconferencing provides fewer channels of communication than face-to-face communication does and requires that messages be coded into written or printed symbols.

2. The omitted channels are typically concerned with regulating ongoing interaction and communicating feelings, intentions, and personal relationships.

3. However, messages of the type mentioned in #2 are implicit in the written channel to some extent, overtly and covertly, and may be brought out through various techniques of analysis.

4. The point of analysis is the submitted entry, after editing (if any) by the participant.

5. Private messages are assumed to be relevant to the public conference, and where available should be correlated with the main discussion.

6. Initial unfamiliarity with the system will affect the number and lengths of a participant's entries, but there is a gradient of learning which leads to a level of relative ease for most persons.

b. A Sample Transcript Analysis

The following is one analysis of the first 20 entries in a FORUM conference on the potential use of FORUM in coordinating the planning of a public event. The entries in the transcript are printed first, and the analysis of each entry follows in italics. There are four participants who will be indicated by their initials: JV and RJ at the Institute for the Future, and EZ and PB at the XYZ office. RJ and EZ had met each other in person once previously, and JV and EZ had talked with each other via telephone.

[1] Z WED 7-NOV-73 3:33PM
Z here, but I guess that's obvious. Thanks for letting me join. I'm giving a demo of the system to P on our staff. P recently joined from ...[the] federal government organization through which we obtain the computer service...P is the real technical wizard at the detail level on the...[net], and I can be counted upon to provide broad brush info, background info, and philosophy of the system. I haven't explained what-all we've talked about on subject, but in the meantime, feel free to direct any questions to either of us.

Initial need to identify self in addition to machine identification. "But" indicates self-conscious realization of this and slight embarrassment.

Awareness of being "let into the group," and thanking for that action.

Definition of presence of PB; definition of PB's role and status.

Implicit request for interaction with PB; wants IFTF to impress PB.

The "I" instead of "he" is either ambiguity re PB's role, or an intended direction of the sentence which was changed in midstream to stay with PB.

Explicit request for including PB, but not clear yet how to do it.

[2] V (CHRMN) WED 7-NOV-73 3:33PM
Hi, E. Where are you right now?

Initial greeting. First name used creates warmth; sets tone of conference formality.

System does not indicate location, so question asks, perhaps to help visualize the participants.

Question also asks "What is your state of mind; what are you thinking about?"

[3] Z WED 7-NOV-73 3:38PM
In our office at...[street names] in Washington

Z answers the overt question; note three levels of detail: office, address, city.

[4] V (CHRMN) WED 7-NOV-73 3:39PM
RA and RJ are here in the office. Why don't we pursue our phone discussion in more detail?

V indicates presence of two others; no definition of role or status (Z knows RJ already).

Implicit definition of situation: demonstration?

V makes agenda suggestion. (Z needs stronger guidance than this.)

Not clear if RA and RJ know about the phone talk.

[5] Z WED 7-NOV-73 3:40PM
Fine. P has some ideas. It might be useful for him to get on line. P, in addition to the other IDs we discussed earlier today, why don't you establish an ID for future, so they can get started. Yesterday I gave them a contact in SFO to get manuals, which they will have tomorrow. In the meantime they've made contact...and they're gonna have their own account. My first thoughts are to give them access to our system: to support the effort to implement FORUM on [the net] thru B account, with FORUM guys doing the implementation, with our help--technical guidance.

Agrees to subject.

Further attempt to include PB; obvious concern.

Talking to PB on FORUM so others "overhear."

Ambiguous discussion, since it is to PB and not to IFTF participants.

Defining roles between IFTF and them, but not to IFTF. This is not for IFTF reply yet.

This may be answer to double level of V's question in #2.

[6] Z WED 7-NOV-73 3:44PM
J, we would appreciate your sending us any documentation you have on the system, so we can begin pondering the technical difficulties. One thing that strikes me right off the bat is that though the full-duplex capability is exciting and efficient, it is confusing [to] the user. And, that capability doesn't happen to be available on the...system.

Z responds to V's first name greeting.

No reference to phone conversation; still caught up in own concerns.

Specific action request.

Statement re "full duplex capability" in a "Yes, but" type, in which "confusing" has more weight than "exciting". Also a personal reference, i.e., "It is confusing to me."

Inference is that Z strongly dislikes being confused.

Implication is that Z would like to omit the full duplex capability, but it is not clear how much weight that preference should be given.

[7] Z WED 7-NOV-73 3:46PM
P, the gentlemen I've talked to so far are RJ, a sociologist and a research associate at the Institute for the Future. Also have talked to HL and JV, who would be responsible for the implementation under discussion.

Third entry in a row by Z. No waiting!

Z introduces people at IFTF; does he do this because V did not?

Z is still not feeling in touch with IFTF and who is there.

You would expect this kind of introduction to be told PB off line; since it is on line, we can infer Z considers it an important aspect for beginning a discussion.

JV is mentioned as an "afterthought" and RA is omitted. Z needs information on them.

[8] V (CHRMN) WED 7-NOV-73 3:47PM
I have some familiarity with data-base systems on-line on...[the net] What is the most practical high level language I can use down there that has good interface with file system?

V tries another type of question. This is also an initial response to PB and the technical aspect introduced by Z.

Also may be asking: "What language can we use with each other?"

Gives some information about his knowledge background.

This does not respond to Z's request in #6.

[9] Z WED 7-NOV-73 3:48PM
FORTRAN is excellent. COBOL is also good, and P likes it (I don't care for it so much). The command language and a combination of COBOL, FORTRAN, and/or DML (Data Management Language), will work. All these languages can be easily mixed, under control of the command language. Within programs, FORTRAN, COBOL, and the Assembly Language (and the command language itself), can be freely mixed as subroutines and/or overlays.

> *Immediate quick response to question with much data.*
>
> *Note negative association to PB. This is more balanced, and suggests that initial high level of concern is dropping.*

[10] Z WED 7-NOV-73 3:51PM
Say, could you include B in the conference, please?

> *Request for PB to be included independently, rather than as a part of Z's channel.*
>
> *Means both "talk to him" and "give him participant status".*
>
> *This is quite different in style--note the three ameliorative, appeal words: say, could, and please.*

[11] V (CHRMN) WED 7-NOV-73 3:52PM
Re, including B: will do.

> *V responds immediately, clear and definite.*

[12] Z WED 7-NOV-73 3:53PM
How can I get the participants status reports in the middle of a conference call, assuming I lost the status report given at the beginning of the session? Also, does the system tell me when someone is entering?

> *Again, here we see concern for being in contact with who is on and what is happening.*
>
> *The first question he has asked on the immediate situation in process, though in the form of a query about the system.*

[13] Z WED 7-NOV-73 3:55PM
Great! 12 just answered. Thanks.

> *The system responds and answers his question by its action, indicating that RJ is joining!*

[14] Z WED 7-NOV-73 3:55PM
Further to 9. In a separate...subsystem is the BASIC capability. BASIC can get to any of the files created by the...subsystem (the one hosting COBOL, FORTRAN, etc.), but because it's in a different subsystem, you can't mix BASIC with the other languages.

Continues answering V's question in #9. Need to give full amount of information.

[15] Z WED 7-NOV-73 3:57PM
Wow! What a helluva tool! More on 8, 9, and 14: B...Is a combination of command language, FORTRAN and DML. The control language is used to initiate the session and to provide certain error traps. FORTRAN sets up all operations (features) and actually does several. DML does all the updating and querying.

The anxiety of the introductions is lowered, and he takes stock of FORUM with a release of positive energy.

Completes his run out of information re V's question.

[16] J WED 7-NOV-73 3:57PM
You will know when someone new enters, E, as you should just have seen as I joined. Hello.

RJ's first entry. Picks up Z's personal concern and relates to that as his initial self identification.

Uses first name greeting.

[17] B WED 7-NOV-73 4:00PM
We have a real need for a powerful assistant such as this to enable us to fill our mandated function to coordinate the projects and events....

PB's first entry.

Compliments FORUM. Says it relates to their need.

Evokes authority of government and via the mandate, their own.

Formal vocabulary and style. Can't be replied to directly; is more an announcement.

Refers to specific events and gives agenda or topic cues.

[18] Z WED 7-NOV-73 4:01PM
Have you established any protocols for usage? For instance, it seems better to terminate one message addressed to an individual, starting a new one for the next person one wants to address, rather than addressing several people in one message. Comment?

Z is concerned with reducing confusion in the flow of the discussion.

Question on methods of organization.

Concern about reducing confusion in the flow.

Question on how to handle the discussion in this medium. What rules or customs help? Openness.

[19] V (CHRMN) WED 7-NOV-73 4:02PM
What do you see as the major conference topics among the different centers?

Responds to and reinforces agenda cues in #17.

Probably realizes that strong guidance is necessary.

B can respond, but is not required to, since the addressee is not specified.

[20] V (CHRMN) WED 7-NOV-73 4:03PM
We tend to observe various "styles" of conferencing in the synchronous mode (as we are now doing). For instance, we often find ourselves having two or three discussion streams going at the same time, and it remains quite comfortable. We begin many messages with "Re topic, etc."

V responds to the question in #18 by saying indirectly that several things can be done at once so long as their references are clear.

Z's question is not answered directly; his need for order may not be satisfied.

Commentary on the analysis. It should be evident that this method of analysis provides a great deal of information about the participants, their interactions with each other, and their attitudes and feelings about the topics discussed. Such information is in addition to the overt semantic content. However, in assessing this information, we must observe several cautions:

1. Because the interpretations are inferences, not truths, they have varying degrees of probability. Ideally, they should be confirmed (or disconfirmed) by the subject himself, as far as possible.

2. It is difficult to assess the weight any one item should carry. Validity comes through repetition of themes and consistencies which can be observed best in longer transcripts.

3. Characteristics and meanings are relevant to the immediate situation; with other participants and other topics, different patterns would likely emerge.

Given such cautions, even with this brief 20-entry transcript, we can note patterns regarding participants, their communication, and the structure of the discussion. In a sense, it is at this point that traditional forms of content analysis come into play, being used not for the original transcript, but to tabulate the occurrence of themes in the analysis.

Themes of the conference. A tabulation of the themes which have emerged and their treatment includes these:

THEME	STATUS
Location of participants	Completed
PB	Completed
Roles of participants	Completed
Telephone conversation	Left hanging
IFTF and XYZ relationship	Not picked up
System features	Continuing
Language for interface	Question answered
Coordination of events	Continuing
Protocols for communication	Continuing

Differences between written and spoken discussion. If it were possible to hold the same conference twice, once on FORUM and once face to face, and then analyze both sessions, we would have good comparative data on the differences between communication in the two media. Failing that, we will draw some conclusions on differences between face-to-face discussion and FORUM teleconferencing based on this transcript in comparison with observational experience of various face-to-face conferences. These observations could be tested more precisely by using discussions on similar topics with the same persons or balanced groups, so that task and individual differences will be minimized and the effect of the media can be seen more clearly.

1. The increased information available in face-to-face communication, because of the increased aural and visual channels, results in an increased number of messages in the discussion.

2. In face-to-face conferencing, there is a greater variance in the length of comments; i.e., there are more long contributions and more short contributions, than in teleconferencing via FORUM, in which entries tend to cluster around an average. In

FORUM, there is a tendency to avoid overlong entries or at least to break long entries into segments. At the same time, there seems to be a tendency to make each entry count and to say more than just a few words. Thus the length of FORUM entries tends to be more uniform.

3. In face-to-face discussion, there are more questions asked of participants than in FORUM conferencing, although it is not evident in the transcript here, which has seven questions in twenty entries. This large number occurs in the opening of the discussion and serves to orient the participants and facilitate interaction. Later in the conference the questions diminish considerably. This is not the case in face-to-face conferences.

4. Interruptions are more frequent in face-to-face discussion. Of course, they are impossible in FORUM conferencing because of the nature of the program. But further, they are a part of the flow of face-to-face conferences and are an obvious difference in the dynamics of the situation.

5. There are some further impressions on differences between written and spoken discussion which are less certain at this point of comparison, but which could be investigated:

   a. Topics range more broadly in face-to-face discussion than in FORUM teleconferencing.

   b. It is easier to get off the track in face-to-face conferences.

   c. There is a higher proportion of implicit decisions in face-to-face conferences; in FORUM, they are made explicit.

   d. There is more interactive adjustment of ideas, frameworks, and communication styles among participants in face-to-face conferences than in FORUM conferencing (or the adjustment occurs at a faster rate).

These methods of content analysis--evaluation of content categories, topic thread analysis, and semantic analysis--are still embryonic. However, they provide a starting point for more exhaustive qualitative evaluation of the effects of FORUM on group communication.

IV. CONCLUSION

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A. MAJOR FINDINGS

The most useful results of our research to date have been in developing a sophisticated computer conferencing medium; in gathering user behavior data and a body of observations drawn from user experience; and in defining viable research approaches based on an initial taxonomy of communications media. We are also prepared to offer some preliminary findings about the social effects of FORUM. This section of the report thus summarizes our current knowledge about the use of computer conferencing.

An appropriate starting point is an analysis of the factors we have found to affect the use of FORUM. These factors can be summarized according to the following categories:

1. Physical Conditions
    a. Threshold of familiarity and skills
    b. Characteristics of the terminal
    c. Access to the terminal and phone link
    d. State of the computer and network

2. Personal Attitudes and Social Needs
    a. Feeling of obligation to use FORUM
    b. Desire to be "in touch"
    c. Work and life style
    d. Need to communicate information relating to role

3. General Social Conditions
    a. Physical separation
    b. Responses to questions
    c. Need for information or understanding
    d. Group task and structure

1. Physical Conditions

a. Threshold of Skills

For computer conferencing to be used with ease, the system must become "transparent"; that is, the physical and mental attention needed for using the system must diminish so that the person can attend to communication itself. Initially, there is unfamiliarity with the terminal, the written mode, and the lack of physical presence of others, as well as other distractions. If the user continues to communicate frequently on the system, some of these unfamiliarities recede, and he learns to use it more or less automatically. We have observed that if someone uses FORUM only intermittently, however, his skills may not be practiced enough to give him familiarity; for many persons, this lack of familiarity will decrease their entries or inhibit their participation.

Typing skills also seem to affect a person's participation, though we do not yet have experimental data on this point. One staff member observed that when a person's typing is slow or uncertain, he becomes more selective in what he answers or when he writes because it is a greater effort, and until that initial threshold is passed, there is reduced participation in the conference.

This fact might be altered if a participant has a second person do the typing for him, but this procedure presents some problems of its own, including delayed responses and removal of the communicator by one step from the medium.*

b. Characteristics of the Terminal

Some terminals are easier to use than others, and each has varying degrees of reliability; these aspects will affect the willingness of a person to be involved in a conference. Hard copy is essential for some needs (e.g., the need for a printed record for reference). But CRT terminals can also be desirable for speed, ease of editing, silent operation, and the absence of unnecessary paper scrolls.

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*An example of a participant doing the typing for another has been given in Volume 1 of *Group Communication through Computers*, Report R-32, pp. 47-51.

c. Access to the Terminals and Phone Links

In order to participate in a conference, the user needs a terminal and a phone link to the computer. Phone links are available in major cities, but terminals usually have to be taken with the traveler since they are not yet in general use in business, industry, and government. We have experimented with the Texas Instruments portable terminals that weigh about 37 pounds and with an Execuport model that weighs 27 pounds; they are both heavy to lug around airports, through Customs, and to professional meetings. This problem is likely to remain until terminals become more portable and more available.

d. State of the Computer and the Network

The state of the computer influences conferencing in two ways. First, when the network is loaded heavily, the time lag (response time) may be high, so that the system takes a long time to transmit messages and even to type the participant's message on his own terminal as he writes it. (This last characteristic is due to the fact that the system uses "full duplex", which requires that the typing go to the computer and be accepted before it types out on the user's own terminal.) The lag, of course, is frustrating and often confusing, since rapid feedback is usually expected for satisfactory communication.

However, this frustration is minimal compared to that which occurs when the system crashes, the computer "stops", and the terminal prints out a message such as "HOST NOT RESPONDING"! In normal usage of computers for data compiling or statistical analysis, a computer failure is annoying. But when it happens in the middle of a real-time conference among several people, dealing with intellectual and emotion-charged matters, the effect is devastating: each person is isolated in midstream.

At present, this factor of network unreliability is a major technical problem which faces teleconferencing. Since most of the Institute conferences have been in the asynchronous (delayed) mode, computer crashes have not seriously hampered participation. However, in synchronous discussion, such as demonstrations, it has occasionally been necessary to change to a second computer when the first one "crashed". For more continuous use of management and conference operations, the program would best be used with a computer whose load is stabilized at a "below-crash" level and whose user interface is properly designed with good attention to human factors.

The unreliability of the network we have used for development and the difficulty in obtaining a sufficient number of guaranteed "ports" (telephone line access points) into a computer have been the limiting factors in our ability to experiment with synchronous (simultaneous) conferencing.

2. Personal Attitudes and Individual Needs

a. Obligation to Use FORUM

One of the basic important factors is simply how much the individual feels obligated to use FORUM in contrast to communicating in some other mode or not communicating at all. This is particularly true in a situation in which face-to-face, telephone, or memo communication is feasible. It takes effort to use computer conferencing, and if it is easier to communicate information in some other way, then the individual's own motivation will be the determining factor. In our own Staff Meeting transcript, there are some evident instances of obligation use, as when one staff member noted that the log of project activities was not being kept up (presumably as it should have been kept up), and another staff member made several contributions after a request for more entries. The staff had agreed earlier in the project to use the conference every day, but the transcript shows that this commitment was not being carried out. There was some sense of obligation, but this did not seem sufficient to maintain a continuous input from everyone.

b. The Desire To Be "In Touch"

Most persons have some need to communicate with others, and some have strong desires to do so. Of the participants, some desired a high level of communication with the rest, while others found this unnecessary. Of course, if the desire for communication is satisfied by face-to-face or telephone meetings in the physical context of the office, it would not be expressed in FORUM teleconferencing unless the individuals were separated, such as they might be if working at home or if away on project matters.

c. Work Style and Life Style

Teleconferencing fits well into the lifestyles of some people--they can do their job, make reports, and talk with colleagues wherever they are, regardless of the time. They can work at home as well as at an office, and they can work at their own pace and time, which may be different from the standard 8:00 to 5:00 office job. For them, teleconferencing is a compatible and even liberating tool, and they are likely to use FORUM to enable them to get into a preferred mode of working and living.

One participant's comment was, for example, that he liked FORUM because he could work at home without time pressure, without interruption ("which would cause me to lose my train of thought"), and at his own pace on creative ideas and thoughts. The results could be viewed by others at their leisure, at their own rate of work.

On the other hand, some people prefer a scheduled, set work time and work space. Rather than finding it confining (as the first group is likely to do), they use it to focus their work attention and separate their job from the rest of their life. These people are likely to use FORUM within the time and space they assign to their work, but not outside those boundaries.

Within the Staff Meeting conference, we have seen a tendency for the staff members to make entries at other times and from other places than the office and the "working hours". All of the staff, at one time or another, made entries after 5:00 p.m. Many of these were from their homes. (The total proportion of entries away from the office was 63 percent, broken down as: 35 percent while traveling and 28 percent while working at home outside office hours. See Volume 1, page 42 for detailed statistics.)

Of course, one would hardly conclude that the FORUM staff is already moving into a new lifestyle with the help of teleconferencing. The traveling was, to some extent, dictated by the responsibility of the staff member rather than being a part of his lifestyle. *The reporting from the destination, however, was a deliberate innovation and a part of the work style made possible by computer conferencing.*

For most of this period, the members of the staff had terminals at their homes as well as at work, but also were under some constraints to appear at the offices of the Institute for the Future every day (e.g., because of expectations from other employees of the Institute). So to some extent, any entries in the Staff Meeting conference which were made on their "off" hours were above and beyond the call of duty, rather than simply work on the project.

One of the major problems in considering social attitudes toward work styles is the language which is available for conceptualizing the situation. Notice these oppositions, which can be seen as "either/or" categories, but which often are not:

job ---------- leisure
work ---------- play
working hours ---------- off hours, non-working hours

Anyone who has worked at any job realizes the unreal categories created by the social definitions of these words. *Accordingly, efforts to change work styles through teleconferencing will encounter the social attitudes which assume that these categories are real.* "Work" has come to mean "8:00 to 5:00 in the office" and also the operations of the job. The two meanings have become equated, collapsed into each other, so that the implications are: (a) what one does from 8:00 to 5:00 in the office is work, even if it includes coffee breaks, and (b) what one does out of the office is not "work", even if it is some operation essential to the job.

The assumptions about the uses and definitions of these terms are arbitrary, but are held unconsciously. Thus, if a person makes entries in a computer conference after "working hours", it may tend to be dismissed or classed as "extra"; and if a person stays at home during working hours and does his job via FORUM, he may be viewed as not doing his work.

FORUM teleconferencing, as used in the Staff Meeting conference, would enable the members of this project (and many other groups) to have a work style which includes carrying out responsibilities away from an office or which is more varied in terms of time. If this should happen, we could expect problems to arise related to criteria for the definition of work and for determining when one is doing work and when one is not. In addition, we could expect that there would be individual personal problems of maintaining work attention in contexts associated with "non-working" activities.

And people who prefer to structure their work activity through the use of time and space might also face new problems.

This aspect of FORUM has not been fully tested by the staff use of FORUM during this period; therefore, few conclusions can be drawn as to the use of computer conferencing by persons with alternative work styles or the effect of FORUM on those styles.

d. Need to Communicate Information Relating to Role

In our ongoing Staff Meeting conference, it became generally evident that each person participates most in the area of discussion (or particular conference) which is most related to his perceived role. Indeed, Figure 25 shows the "participation track" of four Institute staff members in conferences with different topics. Participation rates are seen to vary widely, and no individual appears as "typically private" or "typically public" in all conferences. Role requirements can be recognized. This is hardly a surprising finding, and we expect to be able to generalize it for future FORUM conferences. Furthermore, since FORUM is a new medium for most people, it may be desirable to use established social roles to ease introductory periods and increase participation. However, one of the potential values of FORUM conferencing is to bridge role separation, and this aspect should also be kept in mind when planning a computer conference.

3. General Social Conditions

a. Physical Separation

The function of physical separation in motivating staff meeting entries has already been discussed. When Institute staff members were away on trips, they tended to make a large number of entries reporting their activities. This fact reflects both the physical separation, which excludes face-to-face communication, and also the increased intensity of the person's activities. A further advantage undoubtedly occurs because the "report" of the trip is made quickly, in written form, and is available to all, eliminating the necessity of a formal presentation or a multitude of explanations to individuals.

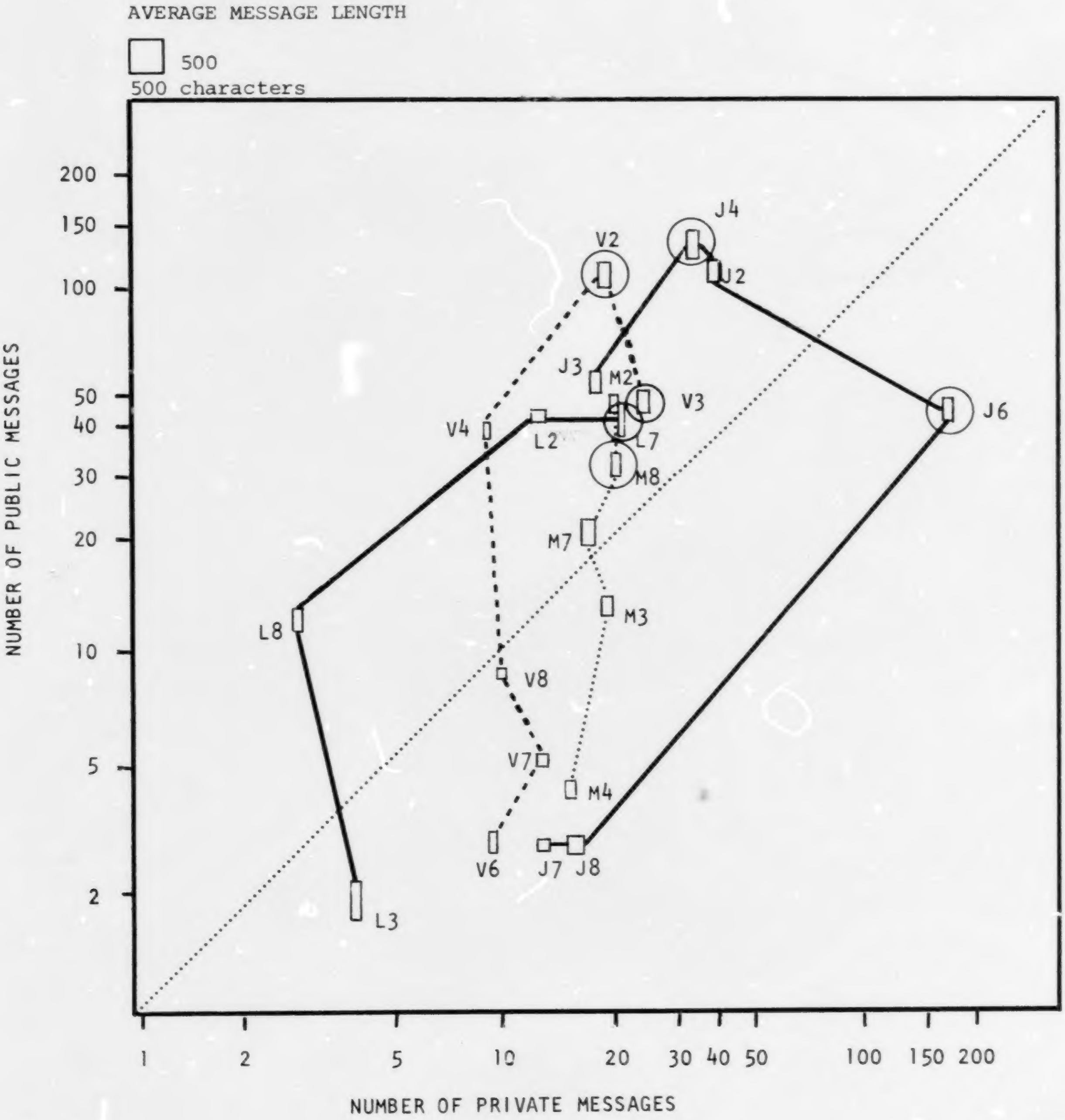


Figure 25. Participation of Four Users in Conferences Dealing with Different Topics. A circle has been drawn around the participant serving as conference facilitator. (J7 represents the participation of Johansen in conference C7, M3 shows the participation of Miller in C3, etc. V designates Vallee and L designates Lipinski.)

b. Responses to Questions

Often, when participating in a FORUM conference, one may simply watch the transcript and, even though interested, make no entries. However, a specific or direct question almost always gets an answer from a participant. This pattern occurs not only because a question has social protocol requiring an answer, but also because a question can specify what kind of answer is required in terms of subject, point of view, and the recipient. Thus, it facilitates any interchange.

c. Need for Information or Understanding

The reverse of the preceding observation is that when a person needs information, he is more likely to make entries. These may be in the form of questions, as above, or they may discuss topics in an attempt to clarify or organize an idea.

The last two activities are evident in the various user reaction conferences. Questions, information-seeking, answers, and discussion comprise a high proportion of the entries in those conferences, and their power to compel participation is evident.

d. Group Task and Structure

Very unstructured tasks and groups will have difficulty adapting to communication via computer conferencing as represented by FORUM. A major factor here is unfamiliarity with a new medium, but there seems to be more to this observation than the learning process. In the Travel/Communication Tradeoffs Conference, for instance, the topic of discussion was not prestructured with any more specificity than the title suggests. There was a general feeling among the participants, registered both in the transcript and in the post-conference questionnaire, that a more focused topic would have been more productive. This criticism was especially important in this conference, since it was the first meeting for many of the researchers. Indeed, we have now proposed to experiment with prolonged conferences on highly structured topics.

It is also possible that there is an optimal threshold of structure in a computer conference. Our finding at this point is that completely unstructured conferences are frequently unproductive. However, it may be that an increase in structure will only be valuable to a certain threshold, beyond which it will not be perceived as positive.

Our efforts have identified many elements of group communication through computer conferencing and have offered some initial conclusions on actual usage--based on about 3,000 terminal hours of actual conferencing. The communication potential of FORUM grows out of its easily available written record, its ability to transcend time and space limitations, and its encouragement of organization. While these characteristics are not all-inclusive, they offer unusual resources for group communication. This report has only begun to summarize and evaluate these potential resources.

B. FUTURE DIRECTIONS

Based on the Institute's substantive experience with FORUM, it is possible to project several areas for future research. Specifically, we have been able to generate a broad range of propositions to serve as general hypotheses for further testing. These are listed in Table 7. In our judgment, most of these propositions are probably true. We do not, however, presume to classify them according to their importance--relative either to one another or to the universe of propositions regarding other aspects of teleconferencing. We present them, instead, as samples of hypothetical statements worthy of future examination.

Beyond these specific and narrow hypotheses, our future research will continue to assess the whole spectrum of social interaction via FORUM as compared with other communication modes. We have found that FORUM enables new kinds of communication. One reason is that, in moving from face-to-face conferencing to teleconferencing via FORUM, a person enters what may be called an altered communication state. Communicating via FORUM is thus likely to involve a qualitative shift in the individual's experience of communicating due to such novel factors as the time delay of the system, the written interactive mode, the absence of visual and non-verbal cues, the physical presence of the terminal, and the behavioral requirements of

Table 7. Tentative Hypotheses for Further Testing

TENTATIVE HYPOTHESES ABOUT COMPUTER-BASED TELECONFERENCING	RELEVANT INDICATORS
There is a lower tendency to digress than in face-to-face modes.	Medium, Frequency of digression
For most persons, the total number of messages submitted is greater than in face-to-face interaction.	Medium, Participation rate, Individual
Affective feelings are not easily expressed.	Medium, Ease of expressing affect
It leads to greater explicitness than other media, especially in decision-making.	Medium, Explicitness, Task
It produces a higher degree of horizontal role interaction than does face-to-face.	Medium, Communication structure
It is preferred to travel for tasks involving information exchange.	Medium, Acceptance, Task
It is preferred to other media when wide participation is desired.	Medium, Acceptance, Group size
It leads to lower costs than other media for information exchange in technical groups.	Medium, Cost, Task, Group type
The distribution of participation rates is different for large and small groups.	Group size, Distribution of participation rates
The proportion of messages devoted to the designated task is positively correlated with the degree of familiarity with the medium.	Familiarity with medium, Proportion of messages devoted to designated task
Previous acquaintance with other group members increases satisfaction with a conference.	Acquaintance with group, Satisfaction
The facilitator of a conference tends to rank high in private message sending and receiving.	Role, Private participation rates and ranking

Table 7 (continued)

TENTATIVE HYPOTHESES ABOUT COMPUTER-BASED TELECONFERENCING	RELEVANT INDICATORS
Across individuals, rank for participation in private mode is correlated positively with rank for participation in public mode.	Private participation rank, Public participation rank
Across individuals, there is a positive correlation between frequencies of comments judged "new" and "provocative."*	Frequency of "new" ideas, Frequency of "provocative" ideas
Across individuals, there is a negative correlation between frequencies of "new" and "synthetic" ideas.*	Frequency of "new" ideas, Frequency of "synthetic" ideas
The extent of humor is correlated with its degree of privacy.	Privacy of conference, Humor
For a given individual, the average length of public and private messages varies with conference topic.	Topic, Characters/public message, characters/private message, Participant
Across conferences, the overall frequency of private messages varies with task.	Task, Frequency of private messages
Increased task structure increases user satisfaction with the outcome.	Extent of task structure, Satisfaction with outcome
The ratio of public to private messages is not uniform across conferences.	Number of public messages, Number of private messages
The average length of messages is greatest at the beginning of a conference.	Time, Length of messages
Direct questions to other participants are more likely to receive at least one response than other message types.	Type of message, Number of responses

*According to coding categories described on pp.

Table 7 (continued)

TENTATIVE HYPOTHESES ABOUT COMPUTER-BASED TELECONFERENCING	RELEVANT INDICATORS
Messages directed to another participant are unlikely to evoke multiple responses.	Type of message, Number of responses
The distribution of message lengths is similar for public and private messages in the same conference.	Privacy of messages, Distribution of message lengths
For a given participant, average message length is greater for public than for private messages.	Privacy of messages, Average message length, Participant
More public messages are submitted than private messages.	Privacy of messages, Frequency of messages
Participation rates in teleconferencing are heavily skewed, with most participants entering relatively few messages.	Distribution of Participation rates, Medium
The growth pattern of conference inputs is not uniform across conferences.	Conference growth curve, Medium

the program. The gestalt constructed from these characteristics feels different from the usual face-to-face communication.

Such an altered state is usually set off from a person's normal behavior and learning, as though it is surrounded by a boundary line which keeps out previously learned behaviors and allows new behaviors to be learned within a free space. What is learned within the new gestalt is associated with it and may not be easily accessible outside that state. This phenomenon has been found in experimental studies using drug-induced states and is also true for conditions ranging from dreaming to classroom learning.

To the extent that such a state occurs in FORUM teleconferencing, we would expect it to have these characteristics:

1. Previous habits and patterns of communicating will be less automatically available and will be reduced in strength. Generalization effects from other communication conditions will be reduced. ("Generalization effect" refers to the tendency to carry over habits learned in one situation to another, similar one.)

2. Interest and excitement will be initially experienced, along with confusion, anxiety, and uncertainty, according to individual personalities. Many people will probably become more responsive to external cues such as instructions.

3. Because the user will not be familiar with the mode, he will have to *learn* how to communicate via FORUM.

4. New modes, styles, or patterns of communication and thinking can be learned more easily and with less resistance as the person learns to use FORUM.

5. New norms and rules of communication can be established, or previously learned ones can be transferred and modified.

The extent to which FORUM produces the above characteristics depends on the individual user and can be enhanced or reduced by the method of presenting teleconferencing to the user, by the instructions which are given, and by any training or teaching which is offered.

Given the potential altered-communication state, *the opportunity is now available for consciously altering present habits of conference communication and exploring new ones*. This opportunity might involve different ways of exchanging information, new techniques of reading, methods of interpreting data, the formation of new styles of expression, multi-level messages, creative thinking and problem-solving, and techniques of resolving disagreement.

Observation of conferences using FORUM already suggests some new modes. One, for example, can be called multi-stream (or multi-topic) communication (as described in Section III-C), in which two or more topics are discussed simultaneously and with more or less coherence. This is possible with FORUM due to the time delay of the system and the adaptation of the users to the multi-stream pattern of thinking. This pattern would not be common or even accepted in a face-to-face conference and would likely confuse the conferees. In the gestalt of FORUM teleconferencing, however, the pattern can be learned without the strictures and inhibitions of face-to-face norms.

A second example of a new mode of communication is the time delay itself. On one hand, this delay could lead to boredom and distraction; but on the other, it often enables the user to expand his sense of time.

Because of the reduction in immediate feedback and non-verbal communication, there is freedom from immediate negative reactions to contributions; that is, negative social reactions are reduced compared to face-to-face communication. People who are inhibited by overt negative reactions might therefore become more expressive in teleconferencing. Similarly, subjects which are tabooed or whose discussion is inhibited in face-to-face communication might be more easily discussed in the changed gestalt of FORUM. This possibility suggests some potential uses for FORUM, including communication between therapist and patient or husband and wife, discussions of values, analysis of assumptions or premises, group psychotherapy, and encounter. Since such conferences would be occurring through the cognitive level of language, the emotional and behavioral effects would have to be evaluated as well.

We view our work with FORUM as an indication that computer conferencing stands at the point where it can be usefully applied to research and business situations. Exactly when and how this application takes place will depend, in large part, upon developments in other fields--the escalation in travel costs, the general state of the economy, the availability of inexpensive terminals, and the growth of data networks.

Our understanding of the human factors involved in the use of computer conferencing and of the psychological parameters will not match our understanding of the technical problems until more research of the type conducted and reported here can be performed and analyzed.

Finally, any forecasting of likely social effect deriving from computer conferencing will have to take into account not only the considerations listed above but also factors such as the growth in demand for information services to homes and neighborhood office centers, the possible recurrence of disruptive energy "crises", and the long-term reduction in the cost of computer hardware.

The propositions we have formulated and, to some extent, tested in the FORUM context indicate that computer conferencing may indeed have an impact not only on travel costs but, more importantly, on the structure of organizations, either in facilitating direct dissemination of information or in promoting horizontal idea exchange. *This impact may be felt within two to five years in the improvement of planning, policy-formulation, and crisis-resolution tools. The effect may widen on this basis to include such diverse activities as citizen participation in planning, resource sharing in education, and the establishment of a permanent medium for the retrieval and dissemination of knowledge.* Such a medium would be unique among computer-based information systems in that it would include the basic units of knowledge--humans themselves.

APPENDIX 1: GROWTH CURVES AND PARTICIPATION MAPS

Care should be taken in making direct comparisons between growth curves from individual conferences, since the conferences vary in length and the logistics of graphic presentation also vary.

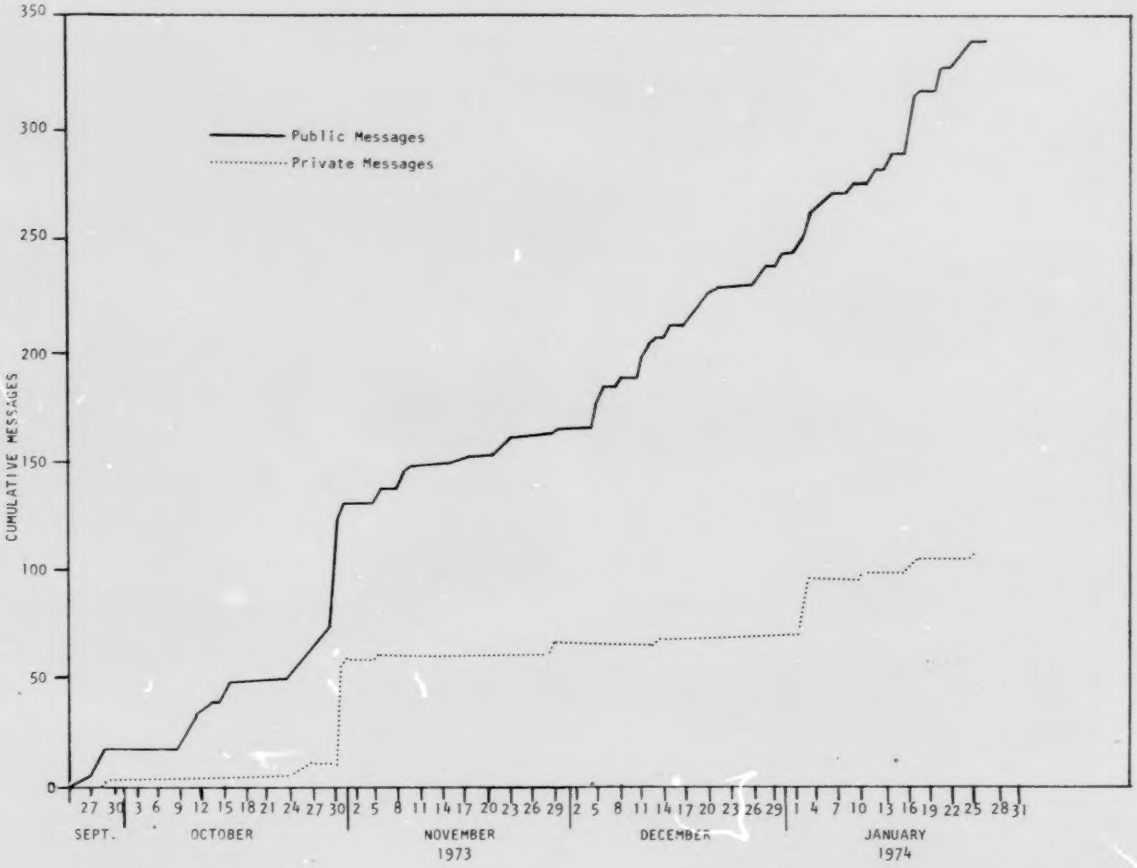


Figure 26. Growth Curve for the FORUM Staff Meeting (C2)

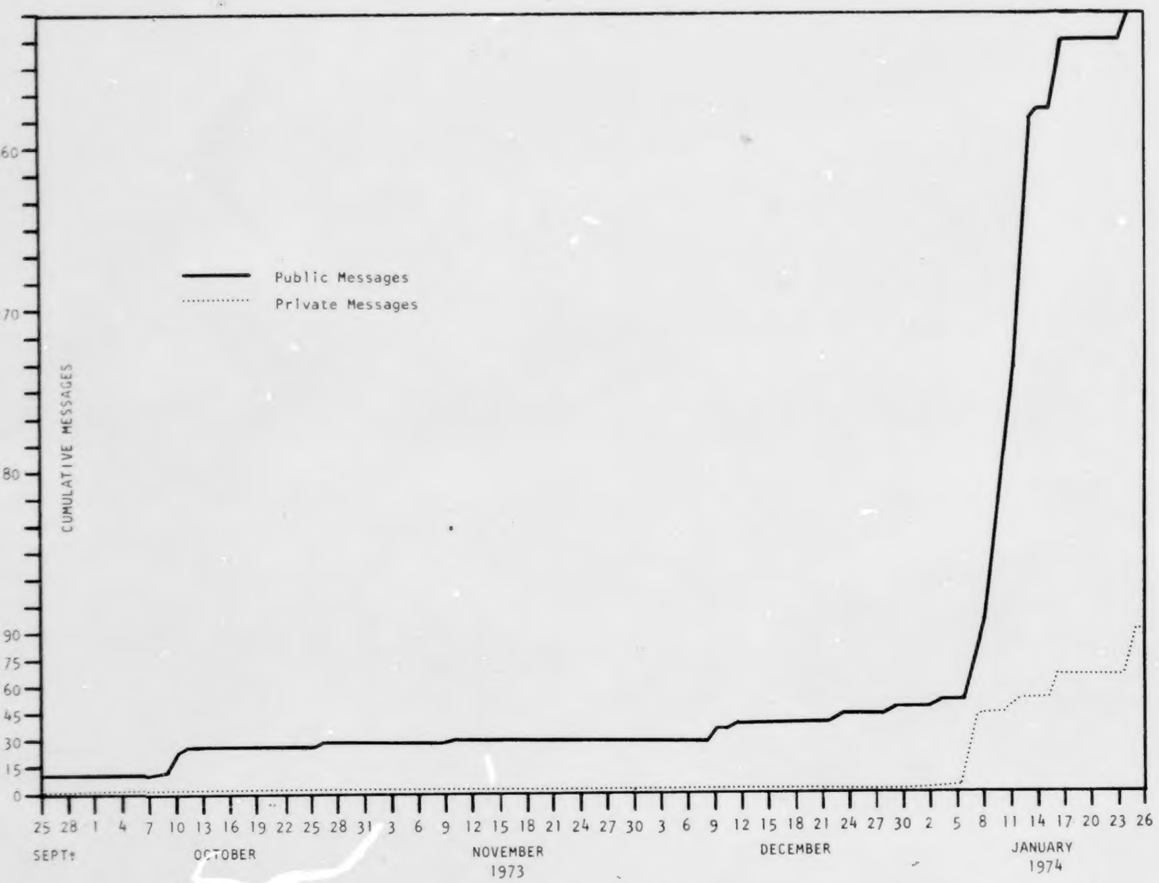


Figure 27. Growth Curve for the Experimental Design Conference (C3)

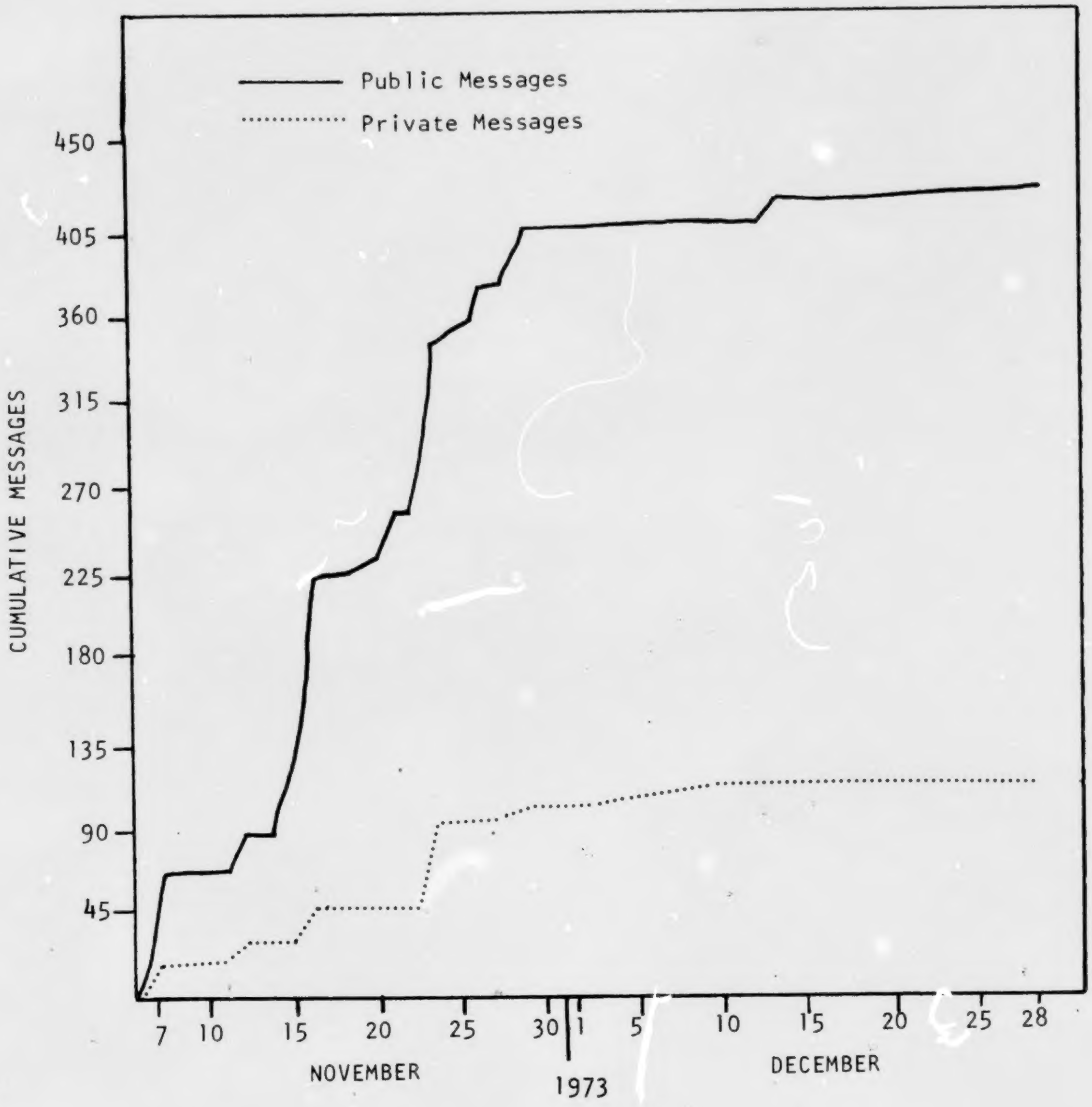


Figure 28. Growth Curve for the IFTF/XYZ Conference (C4)

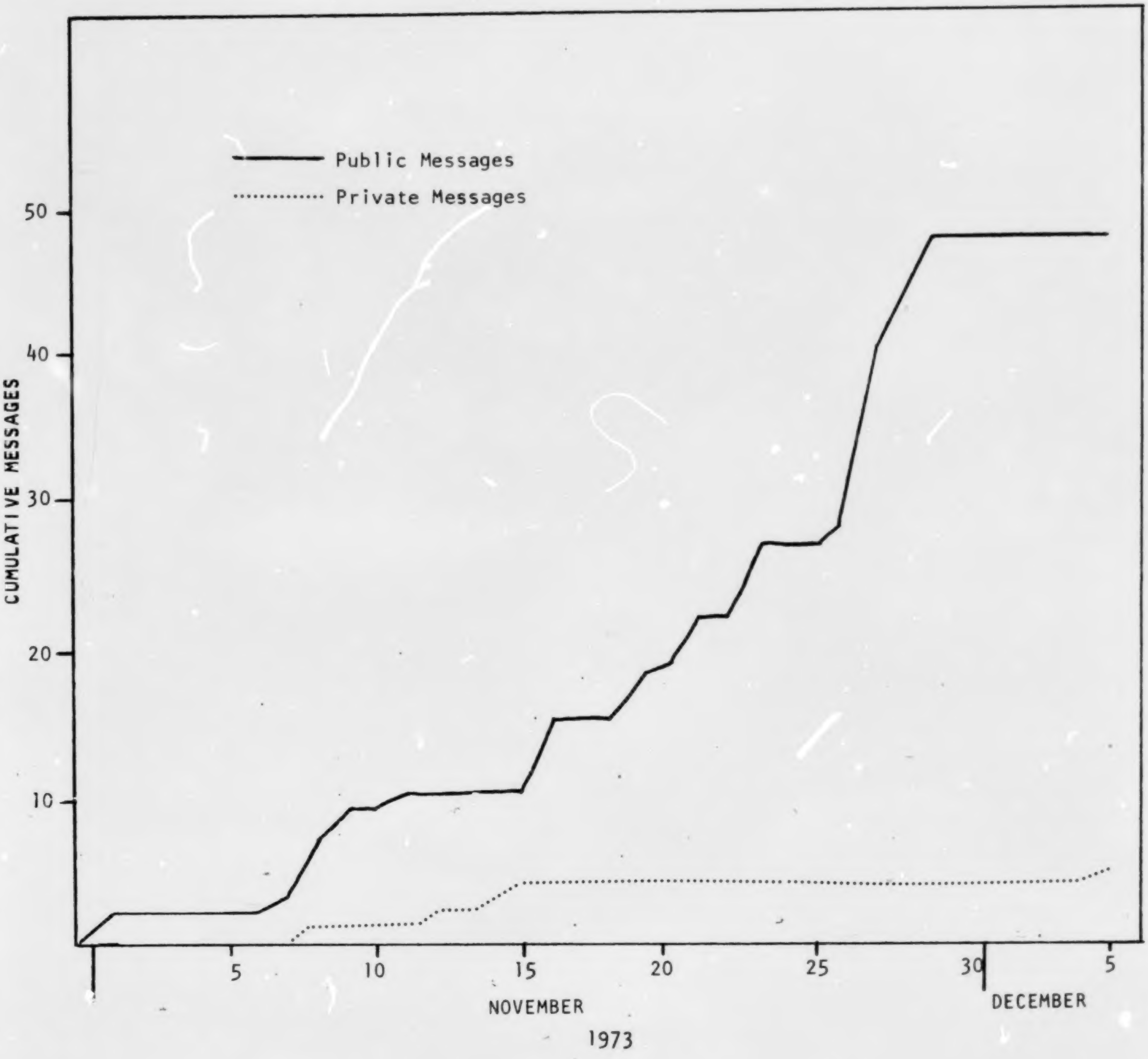


Figure 29. Growth Curve for the WPO Conference (C5)

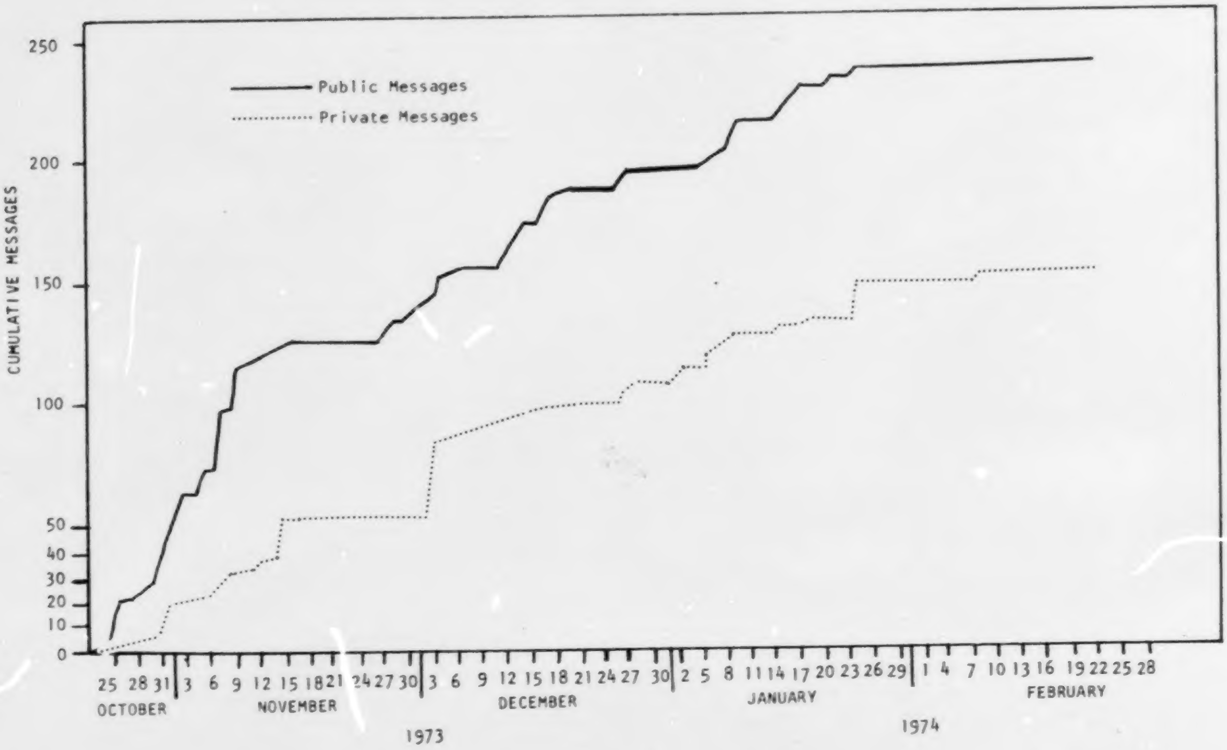


Figure 30. Growth Curve for the Users 1 Conference (C7)

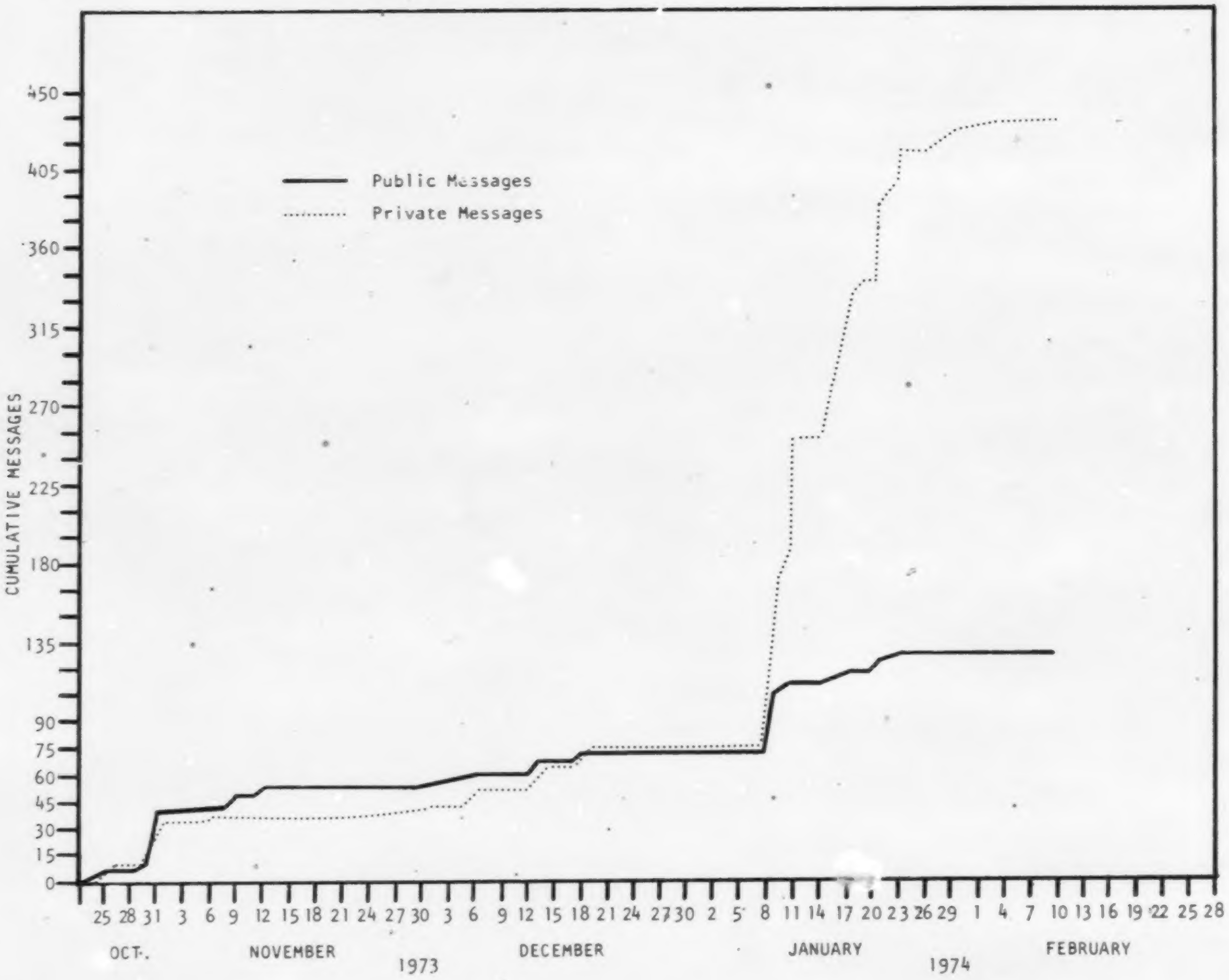


Figure 31. Growth Curve for the Users 2 Conference (C8)

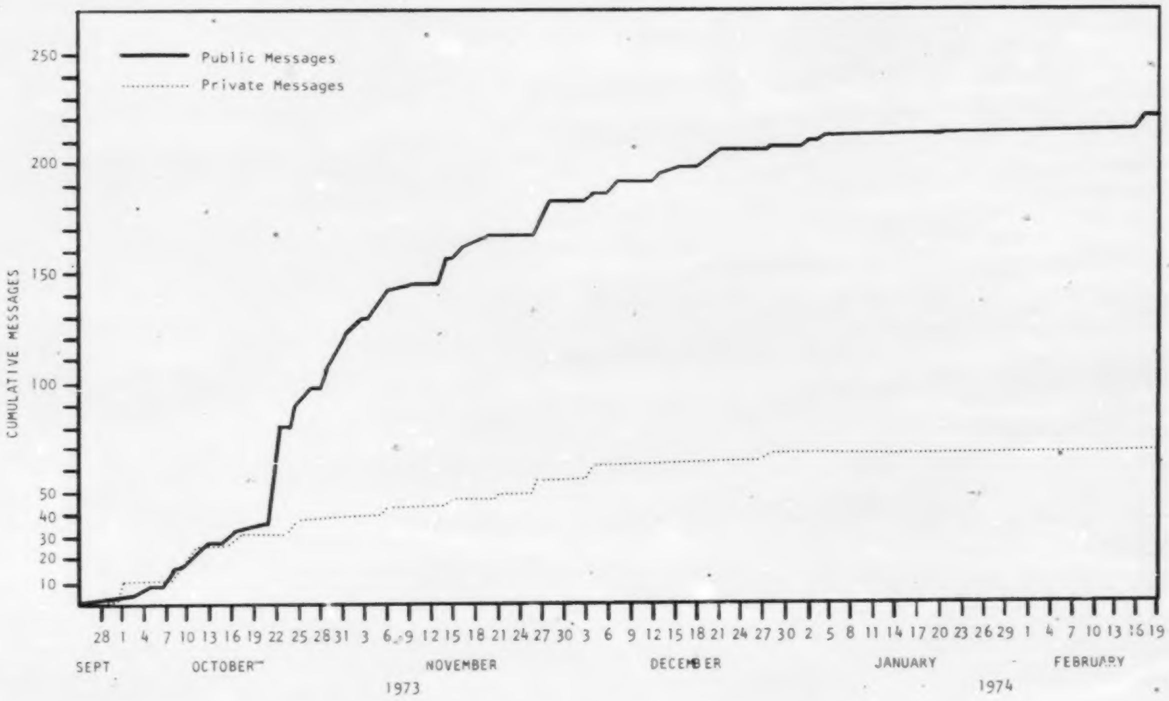


Figure 32. Growth Curve for Conference C9 (No FORUM Staff Participation)

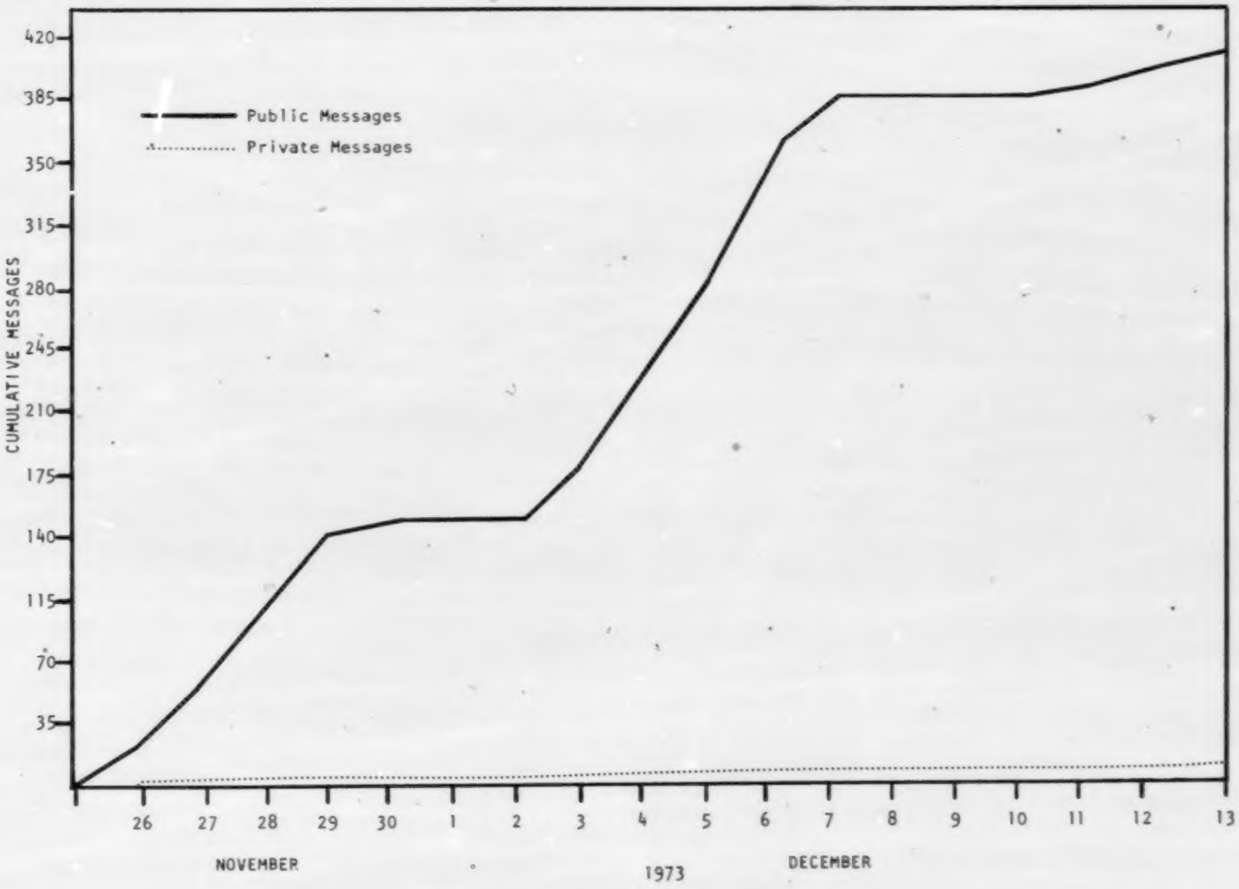


Figure 33. Growth Curve for Conference C10 (No FORUM Staff Participation)

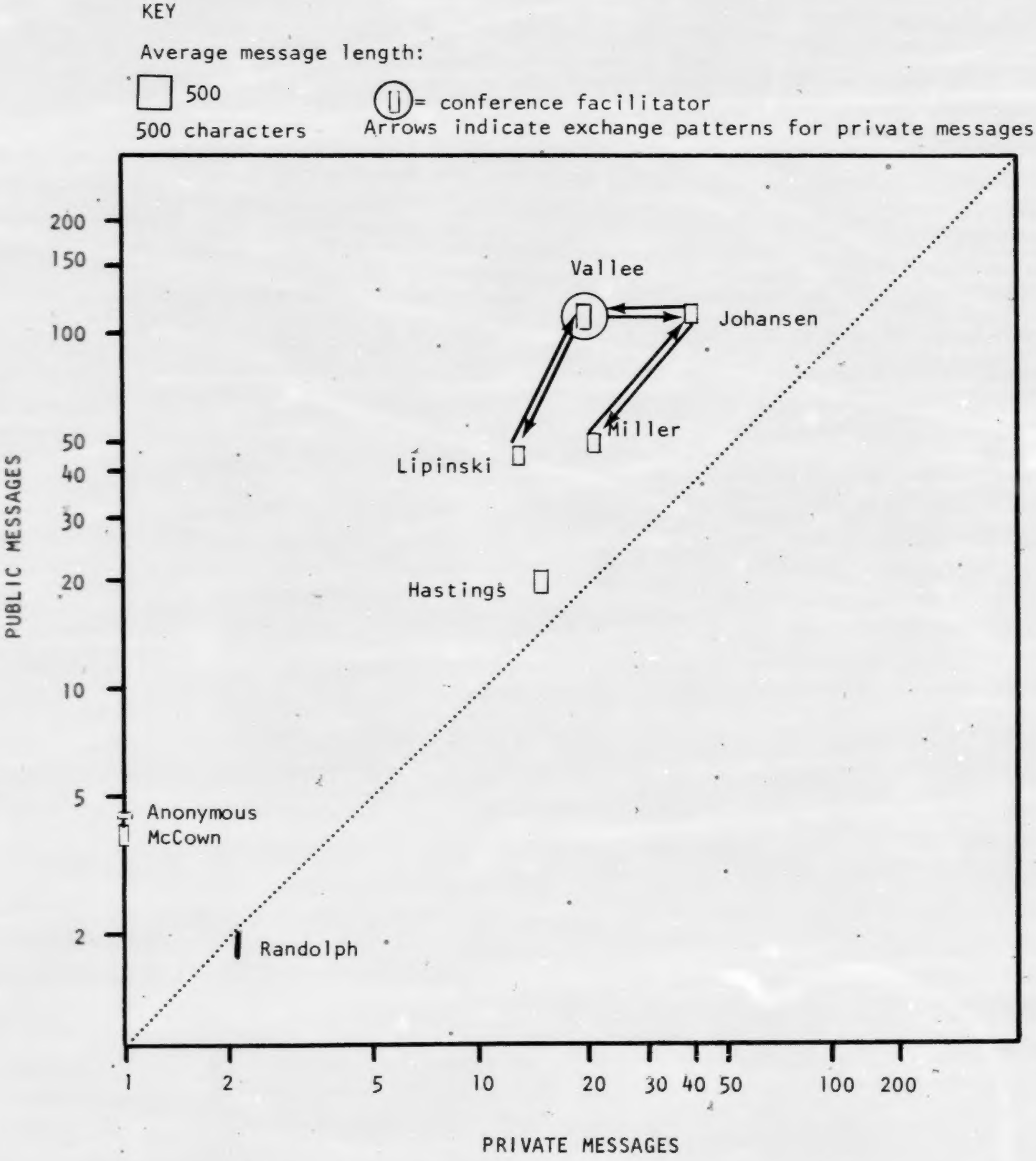
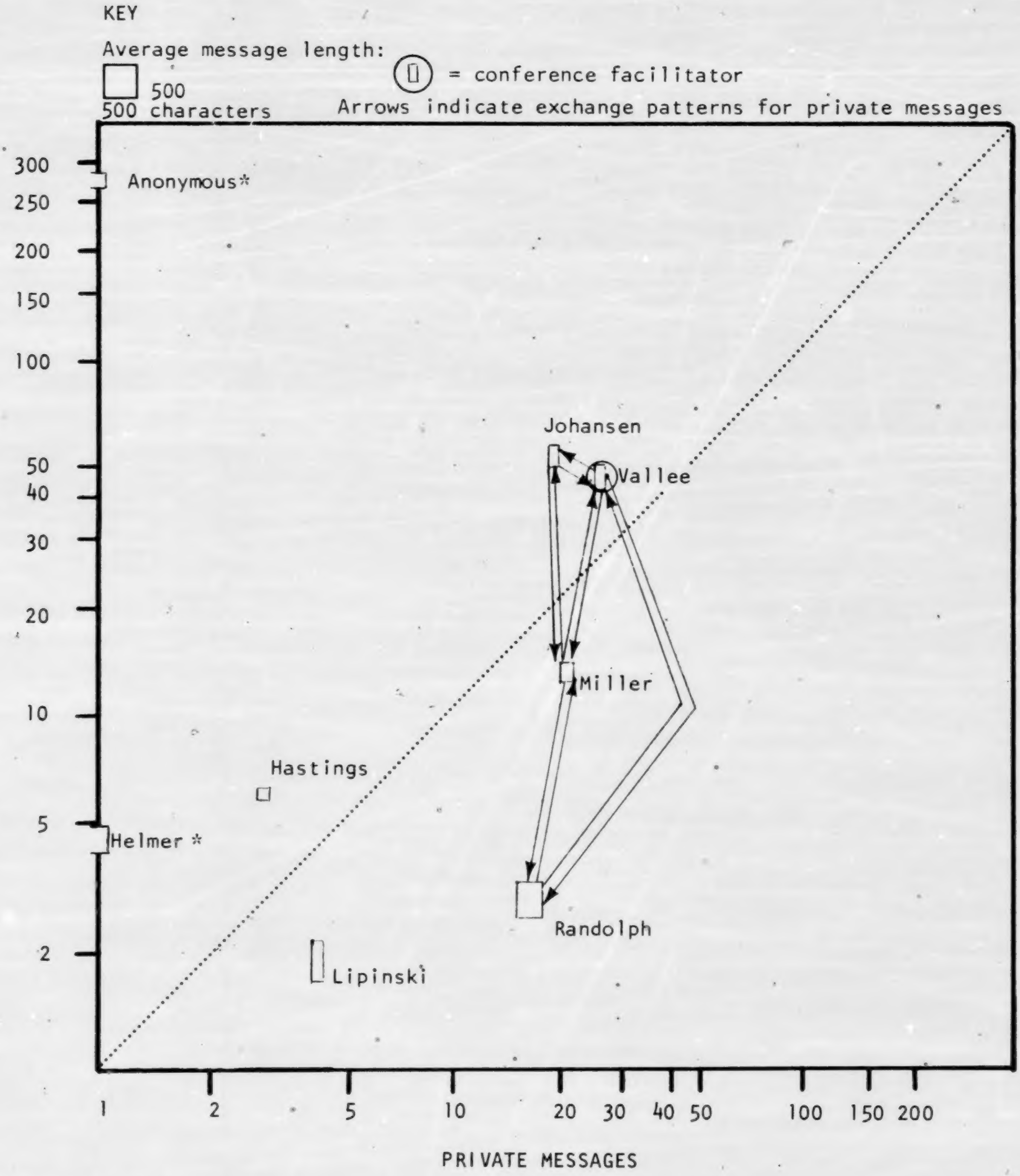
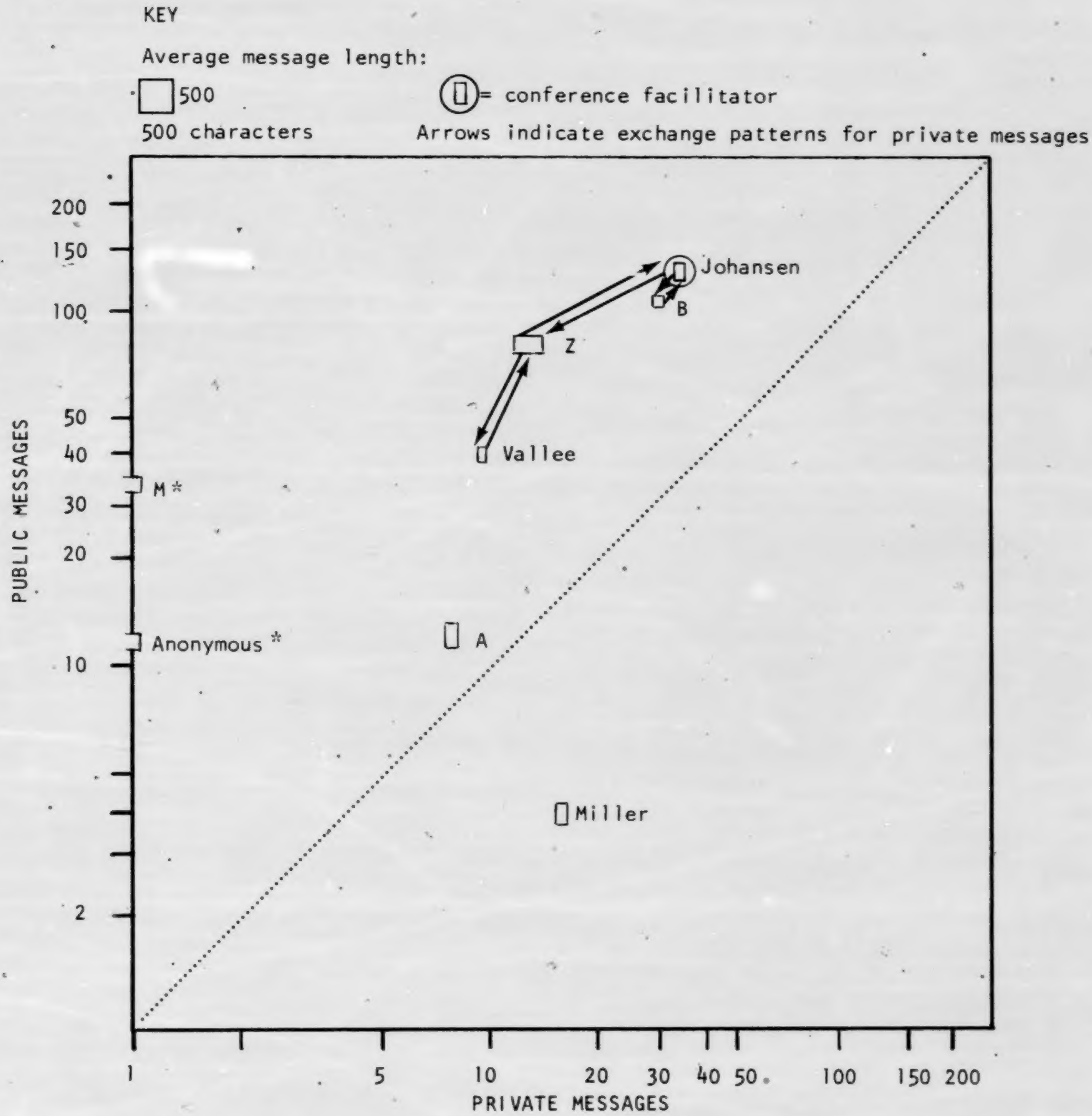


Figure 34. Participation Map for the FORUM Staff Meeting (C2)



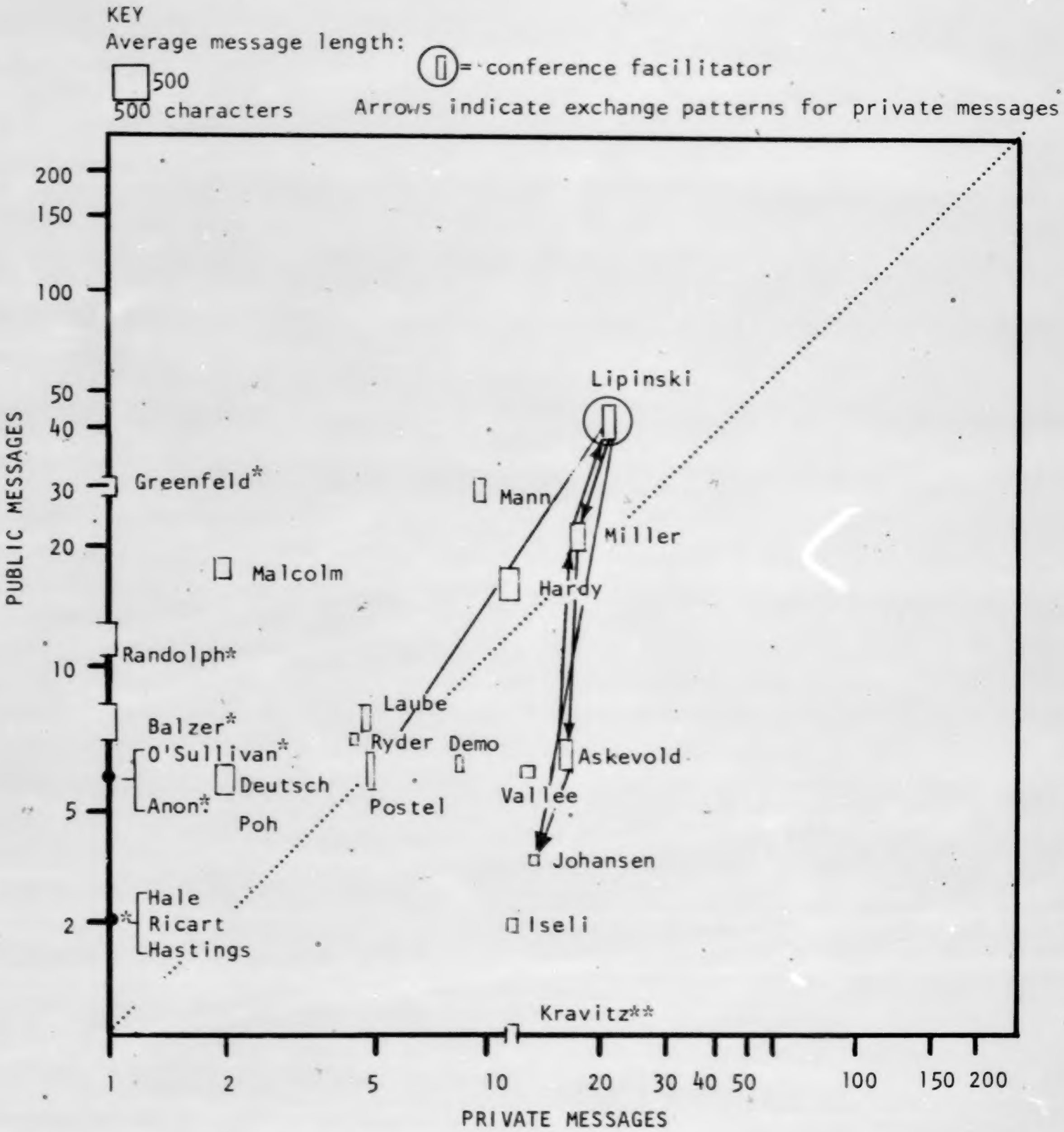
*Indicates no private messages

Figure 35. Participation Map for the FORUM Experimental Design Conference (C3)



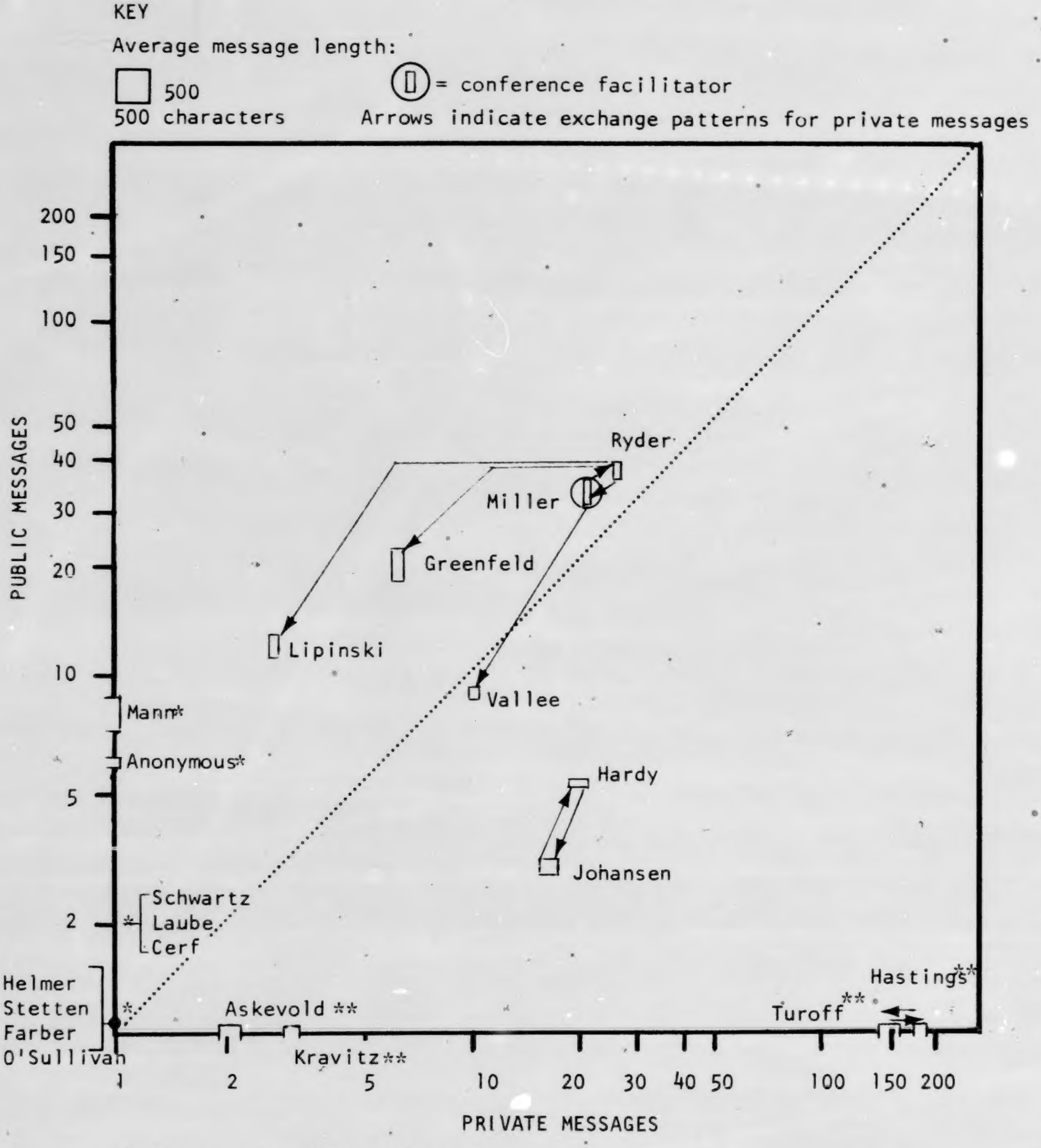
*Indicates no private messages

Figure 36. Participation Map for the IFTF/XYZ Conference (C4)



*Indicates no private messages
**Indicates no public messages

Figure 37. Participation Map the Users 1 Conference (C7)



*Indicates no private messages
**Indicates no public messages
(Note: The label "Turoff" reflects the participation of both Dr. Turoff and one of his students participating under his name.)

Figure 38. Participation Map for the Users 2 Conference (C8)

APPENDIX 2: INITIAL INTERVIEW SCHEDULE

APPENDIX 2

INITIAL INTERVIEW SCHEDULE

August 1973

Since you are part of the first group to have any extended experience with FORUM, we would like to record your reactions and criticisms. At this point, we are particularly interested in your criticisms of FORUM as it is now--as well as the potentials you might see for the program.

GENERAL QUESTION: What are your overall impressions of conferencing using FORUM?

PROBES: What about computer conferencing in general?

Positive:

Negative:

What about FORUM specifically?

Positive:

Negative:

How frequently did you get hard-copy transcripts of the conference sessions?

How did you use these transcripts? (e.g., read carefully, skimmed, made detailed comments in reaction, etc.)

How did you use the actual time you were in the FORUM program? (e.g., responded immediately, only skimmed other comments, etc.)

GENERAL QUESTION: How has your group changed since you began using FORUM? (Try to be as specific as possible.)

PROBES: How much of this change *do you feel* was related to using FORUM?

What about negative effects of using FORUM?

What about positive effects?

How have your face-to-face meetings been different from the FORUM conferences?

Do you think your FORUM conferences could have been conducted as well using some other technique? (Try to be as specific as possible.)

GENERAL QUESTION: What do you see as the most beneficial applications of FORUM in the near future?

How are your typing skills?

INSTRUCTIONS

Please read carefully

The following scales are designed to assess feelings and attitudes toward various communications media. There are 24 scales altogether. Even if some of them seem strange, or inappropriate, it is very important that you complete them all.

Please consider

FORUM as a communications medium.

You have just had a discussion using FORUM. *Please don't think about the discussion itself,* but consider the actual medium that you used for the discussion.

Work rapidly through the scales, without pausing for more than a few seconds on each one and without returning to one you have already completed. You shouldn't take more than 2 or 3 minutes to complete the whole set.

While considering

FORUM as a communications medium,

please place a check at the point on the scale which you consider to be most appropriate.

boring ___ : ___ : ___ : ___ : ___ : ___ : ___ interesting

colorless ___ : ___ : ___ : ___ : ___ : ___ : ___ colorful

complex ___ : ___ : ___ : ___ : ___ : ___ : ___ simple

constricted ___ : ___ : ___ : ___ : ___ : ___ : ___ spacious

excitable ___ : ___ : ___ : ___ : ___ : ___ : ___ calm

free ___ : ___ : ___ : ___ : ___ : ___ : ___ constrained

good ___ : ___ : ___ : ___ : ___ : ___ : ___ bad
important ___ : ___ : ___ : ___ : ___ : ___ : ___ unimportant
meaningless ___ : ___ : ___ : ___ : ___ : ___ : ___ meaningful
passive ___ : ___ : ___ : ___ : ___ : ___ : ___ active
periodic ___ : ___ : ___ : ___ : ___ : ___ : ___ erratic
pleasurable ___ : ___ : ___ : ___ : ___ : ___ : ___ painful
public ___ : ___ : ___ : ___ : ___ : ___ : ___ private
reputable ___ : ___ : ___ : ___ : ___ : ___ : ___ disreputable
sensitive ___ : ___ : ___ : ___ : ___ : ___ : ___ insensitive
soft ___ : ___ : ___ : ___ : ___ : ___ : ___ hard
stable ___ : ___ : ___ : ___ : ___ : ___ : ___ changeable
strong ___ : ___ : ___ : ___ : ___ : ___ : ___ weak
tenacious ___ : ___ : ___ : ___ : ___ : ___ : ___ yielding
true ___ : ___ : ___ : ___ : ___ : ___ : ___ false
ugly ___ : ___ : ___ : ___ : ___ : ___ : ___ beautiful
unsociable ___ : ___ : ___ : ___ : ___ : ___ : ___ sociable
unsuccessful ___ : ___ : ___ : ___ : ___ : ___ : ___ successful
small ___ : ___ : ___ : ___ : ___ : ___ : ___ large
friendly ___ : ___ : ___ : ___ : ___ : ___ : ___ hostile
impersonal ___ : ___ : ___ : ___ : ___ : ___ : ___ personal
technical ___ : ___ : ___ : ___ : ___ : ___ : ___ non-technical
relaxed ___ : ___ : ___ : ___ : ___ : ___ : ___ tense
informal ___ : ___ : ___ : ___ : ___ : ___ : ___ formal

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